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NOTES ON DRY-FLY FISHING. No. 2.

By R. L. M., California.

In the first of this series of notes on dry-fly fishing I believe I was, to a certain extent, successful in dispelling the cloud of fog or mystery that surrounds the art in the mind of the average man; but before going any further into the technique of the dry-fly school, I propose to trace the history of this modern method of catching fish, which is described by Emerson Hough as being "the most beautiful form of the most beautiful sport." (Extract from a letter to the author.)

I have already remarked that, if a new fly is dropped on the surface of the water, it will float as long as it keeps dry. It is quite probable that those Macedonian fishermen mentioned by Aelian in "De Animalium Natura" (A. D. 230) were aware of this fact. Since this writer, the first who describes fly-fishing and a method of dressing flies, was not a very accurate recorder, we may take it that practically all his observations on nature were made second hand, consequently, we must not put too much reliance on his description of the flies used. Furthermore, the lengths of rods and lines that he states were used, were entirely too short for any practical purpose.

Scotcher ("Fly-Fisher's Legacy," 1807) makes, I believe, the first mention in print of the fact that a new fly will float. This fact, which

can hardly be called a discovery, is known to every one who has ever fished to any extent with a wet fly. In a little book ("Anglers' Desideratum," 1839) the author, Capt. Clarke, R. N., describes a method of catching fish on hot sunshiny days, which has all the earmarks of dry-fly fishing with the single exception of floating the fly.

The late Emlyn M. Gill in his book "Practical Dry-Fly Fishing" (New York, 1915), writes of Mr. G. P. R. Pulman having "explained dry-fly methods in 1851." This explanation, which appears on page 132 of Pulman's "Vade Mecum" (1851, 3d ed.—the two earlier editions made no mention of the dry-fly) is not of very great length, so I will include it in this brief history:

Let a dry fly be substituted for the wet one, the line switched a few times through the air to throw off its superabundant moisture, a judicious cast made just above the rising fish, and the fly allowed to float towards and over them, and the chances are ten to one that it will be seized as readily as a living insect.

Although the foregoing leaves very little undone to be a full description of dry-fly fishing, I do not think that in the light of latter-day evidence we can call Mr. Pulman a dry-fly man as the term is understood today. What he really did do was to emphasize the importance of the first cast with a new (dry) fly. His son in a recent letter told me: "I recollect that he (my father) often told me to dry the fly by flicking it about before taking a cast over a rising fish. He invariably fished down stream with two wet flies."

If we leave Mr. Pulman's description on one side as being doubtful, or of the nature of the Scotch verdict "not proven," the first real mention in print of dry-fly fishing is found in "A Book on Angling" (Francis Francis, 1867). Although there are over four hundred and fifty pages in this angling classic, only on three or four of them is there any slight reference to this new art of fly fishing. At the time Mr. Francis wrote this book he evidently did not attach any great importance to dry-fly fishing. David Foster ("The Scientific Angler," 1882) makes occasional references to dry-fly fishing and in some of the later editions there is a colored plate of dry flies. In the "Badminton Library" (1885) Mr. H. S. Hall gives a short but complete treatise of the art, together with the dressings for eighteen dry flies. Both Halford and Foster give Mr. Hall the credit for the invention or adaptation of the eyed hook to flies of small size such as are used for dry-fly work.

The literature relating to the art may be said to have still been in an embryotic, if not a chaotic, state, when in 1886 Frederick M. Halford published his first work, viz., "Floating Flies and How to Dress Them." Besides fairly extensive contributions to periodicals devoted to sport, he found time in the following years to produce: "Dry-Fly Fishing in Theory and Practice"; "Dry-Fly Entomology"; "Making a Fishery"; "An Angler's Autobiography"; "Modern Development of the Dry-Fly"; and finally in 1913 "The Dry-Fly Man's Handbook." This last work has somewhat of an analogy to Rudyard Kipling's "Day's Work." Between its covers is epitomized the knowledge and experience of a lifetime devoted to fishing.

Of late years it has become the fashion among a certain class to question and even to ridicule some of his theories, but it should not be forgotten that Mr. Halford never put a line on paper until he had satisfactorily demonstrated its correctness by painstaking attention to detail and laborious study. If I may be allowed to use a distinctively

American colloquialism: "Halford put the dry-fly on the map"; that sums the matter up in a single sentence.

Among the other books devoted to the art I might mention "Fly Fishing," 1899, by Viscount Grey of Fallodon, or as he was known then, Sir Edward Grey.

On this side of the Atlantic besides Mr. Emlyn M. Gill's book already mentioned, the following have appeared: "The Dry-Fly and Fast Water," by George M. L. La Branche (N. Y., 1914); "Fishing with Floating Flies," by S. G. Camp (N. Y., 1916); and possibly one or two others.

The use of the dry-fly in America is of quite recent occurrence. The fact of the matter is that, until lately, our rivers and streams were swarming with fish that seemed only too anxious to rise to any artificial fly that was presented to them; but increasing population and better methods of transportation have brought many more men to the water-side in quest of sport than was formerly the case. The trout have become more wary and greater finesse has to be employed in their capture; consequently the dry-fly has been utilized as a means of overcoming their increased shyness. It is only to be expected that in England, with its denser population, these same conditions arose earlier than they did over here.

There are two rivers in the south of that country which are pre-eminently dry-fly streams. I refer to the Test and the Itchen. Sometime during the forties or fifties of the last century the dry-fly was first used on these waters. (See "Chalk Stream and Moorland," Russell, London, 1911).

To no single individual can be given the credit for the discovery, invention or development of the art of dry-fly fishing. I believe that what actually did happen is that different men hit on much the same thing about the same time. Their knowledge, which in the beginning was purely local and personal, became in the course of time more general, so that by the time the late sixties arrived, the art can be considered to have been fairly well established on these two rivers and on other streams of a similar character that are found in the south of England.

But although dry-fly fishing was quite common, so much so as to be considered the sole means of catching trout by some; in fact, Mr. Halford states that the dry-fly was used exclusively on the Wandle for the last half century, i.e., since 1863. (See "The Dry-Fly man's Hand Book," p. 66), it was not the universal method that it is today on these typical dry-fly waters.

"The Chronicles of the Houghton Fishing Club" were printed in 1908. This club has been in existence since 1822 and during most of that time leased or owned riparian rights on the Test. From the historical point of view there is not a great deal of information to be derived from a perusal of the Chronicles, which deal chiefly with fish caught and other matters; but we can glean some information both useful and interesting.

In the early days when the May fly (Green Drake) was up, the club members used to catch fish by "blowing." This consisted of using the natural fly as a bait together with a long light bamboo rod and a floss silk line. The wind was allowed to carry out (blow) the bait over the water, and by proper manipulation of the rod the fly was

dropped on the surface just above a feeding trout. (Information contained in a letter from A. N. Gilbey, honorary secretary of the club, to the author; also see chapter XXIII, "Fishing," Vol. I, "Country Life Library of Sport" [London 1905].) "Blowing" was still practiced as late as the early nineties. The first mention in the Club Chronicles of the capture of a trout on the artificial May fly is on June 6, 1888; but a much earlier record of such a feat on the same part of this river is made by Col. Peter Hawker, of Longparish House, in his Diary, viz, June 11, 1817.

The sixties may be regarded as the transition period. During these years the dry-fly was becoming more common and the wet-fly was fast disappearing. Mr. J. Ernest Pain, who has lived at Chilbolton on the Test since the early seventies, told me that an old fly book belonging to an uncle, which was used in 1860, contained nothing but wet flies.

In the seventies the dry-fly was almost universal. Writing about the fishing on the Itchen from 1877 to 1880, Lord Grey remarks: "These Winchester trout taught us the necessity of using fine gut and small flies, and of floating the fly accurately over a rising fish." Even so the wet fly had not quite entirely vanished from these rivers. As late as 1890 a relative of mine who had owned fishings on the Test since 1850, told me that he never used the dry-fly and that he considered it a modern innovation that was quite unnecessary. As he had a number of fine specimen fish mounted in glass cases, his contention would seem to have been fairly proved; but such is not the case at all. My relative did all his fishing on his own private water where the trout were not harried by any one except himself and an occasional friend. There were weeks, nay months, when these fish never had a line cast over them and therefore we can readily believe that they could be taken on a wet-fly. The dining room of his fishing cottage projected over the river. There was a short distance on both sides of the house where fishing was never permitted, but his daughter told me that when her father and the keepers were away she used to catch these trout, with bread for bait, from the window. On the other hand at Winchester where Lord Grey fished, there were always a number of other men fishing and the trout became highly sophisticated. Earlier in his book Lord Grey speaks of the absolute lack of sport he experienced with the wet-fly on these waters, and it was not until he used a dry-fly that he had any success at all. ("Fly-Fishing," p. 108.) I consider that these facts amply prove the contention of most dry-fly men, viz: That fish can be and are caught with a properly presented dry-fly, which would not look at, much less take, a wet-fly.

Before the end of the last century certain rivers in England had become dry-fly waters, i.e., the use of anything but the dry-fly was prohibited, and it was regarded as a heinous offense to do otherwise.

The history of the art on this side of the Atlantic is brief; in fact I might almost say that it is in the making today. Dry-fly fishing has been practiced for some few years on the Catskill and other streams in the eastern states and is occasionally met with on our western rivers; but the necessity for it has not arisen except in a few localities where fishermen are almost as numerous as the fish. I learned the art in the eighties, but for years I fished almost entirely with a wet-fly, only occasionally using a dry-fly for an exceptionally cautious fish. However, of late years I have found the fish much wiser and not so easy to

catch. The automobile is mainly responsible for this condition. Fifteen years ago I used to very rarely meet others bent on fishing, but nowadays I have frequently counted as many as ten men in sight at once lined out along the stream. Consequently I have been, for some years past, using nothing but the dry-fly; and I think it is only a question of time when the dry-fly will be much more generally used on American trout streams than it is at present.

THE YOUNG OF THE BLACK SEA-BASS.*

By ELMER HIGGINS.

One of the most picturesque fishes of Southern California, well known and appreciated by sportsmen and commercial fishermen alike, is the giant black sea-bass or California jewfish, *Stereolepis gigas* Ayres. It is a common sight to see one of these huge fishes hung up by the jaw before fish markets and on pleasure piers, surrounded by wondering tourists. But although over a million pounds are landed yearly in the markets, the fish caught all range in size from about three to six feet in length. The commercial fishermen never admit having seen a jewfish less than one and a half or two feet in length, and all declare them to be dull black in color and without markings, as are the larger ones.

Imagine our surprise then, when we discovered that certain pretty little bass-like fishes from the hauls of the boat "Albacore" were the young of the jewfish! These resembled the huge, ugly adults neither in form, color, nor markings, as may be seen from figure 1.

Several specimens of the young of the jewfish have been taken in the otter trawls of the "Albacore" in shallow water on the Southern

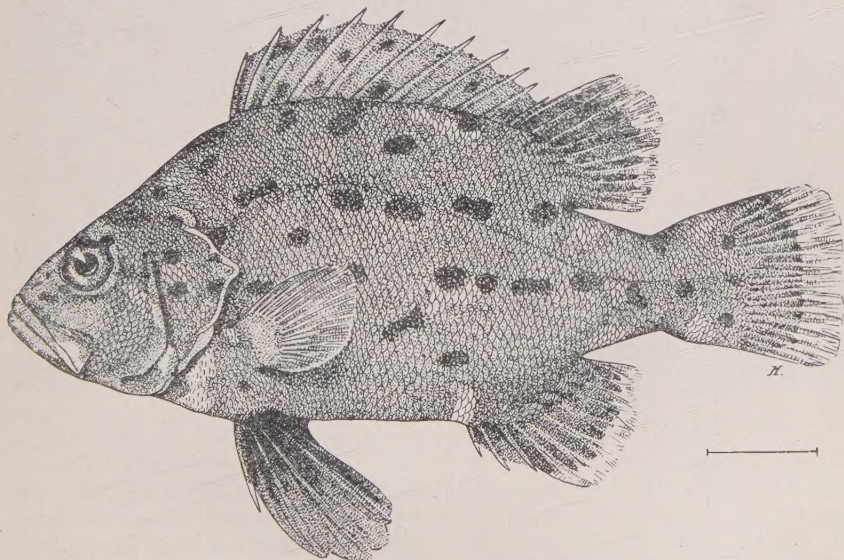


FIG. 1. Young jewfish. *Stereolepis gigas*. Total length $7\frac{1}{2}$ inches. Long Beach, California, September 13, 1919.

*California State Fisheries Laboratory, Contribution No. 13.

California coast at different dates: December, 1918, specimen $1\frac{1}{2}$ inches long; April, 1919, specimens 4 to $4\frac{1}{4}$ inches long; and September, 1919, specimens $7\frac{1}{2}$ to 9 inches long. The depths were from 4 to 15 fathoms.

The most striking change in the development of the jewfish is that of color and markings. The younger specimens are a rich brick-red in color and marked with conspicuous dark brown or black spots irregularly scattered over the back and sides. There are also white or pale yellow splashes here and there on the body, especially on the throat and ventral side of the tail. The vertical fins are black with conspicuous transparent edges, the ventrals black, and the pectorals pale or transparent. As the fish grows older the body color darkens and the spots become indistinct until the whole color is a uniform dark brown or dull black, except for the light patches on the throat and ventral surface of the tail which often persist even in the larger adults. All the fins become black except the ventrals, which, though black in the young, are lighter than the pectorals in the adult, showing white membrane between the black fin rays.

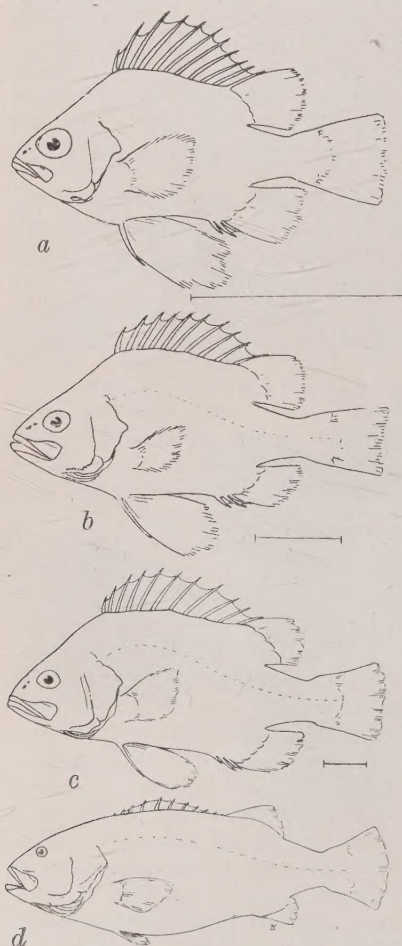


FIG. 2. Changes in the development of the jewfish. Size of specimens: a. $1\frac{1}{2}$ inches long; b. $4\frac{1}{4}$ inches; c. 9 inches; d. 72 inches (weight 305 lbs.).

The change of form in the development of the fish is almost equally as marked. Figure 2, in which all the stages are reduced to one size, illustrates graphically the change in body proportions and size of fins, from the smallest specimen to the largest. It seems that the dorsal fin is practically submerged by the growth of the body, and indeed one or two of the dorsal spines are often entirely covered by the flesh. The remarkable change in the proportions of the pectoral and ventral fins is also evident. In the young the pectorals are about .23 of the body length and the ventrals are .40, while in the adult the pectorals are about .15 and the ventrals .12.

That the young of the jewfish or black sea-bass should be spotted or brightly marked is not surprising when we remember other closely related Serranoids which are brilliantly marked, such as our kelp bass, the striped bass, or the groupers of Florida and the West Indies, and it is indeed strange that they have not been recognized before. But the bright color and the different form of the body combined with the apparent inaccessibility, since they never appear in the markets, have protected the identity of this giant's young from the fisherman and public until the present time.

THE PACIFIC EDIBLE CRAB AND ITS NEAR RELATIVES.*

By FRANK WALTER WEYMOUTH, Stanford University, California.

The edible crab of the Pacific Coast markets is familiar to most people but there are a number of other species less well known and somewhat likely to be confused with it. It is the purpose of this note to prevent this confusion. Since there are between fifty and a hundred distinct species, many of small size, on the coast, it is a mistake to imagine that any small crab is the young of the edible form. Many are so widely different that even a hasty examination will show the most uncritical that they are not market crabs, but there are four closely related species which are particularly liable to confusion and which will be considered in more detail.

The edible crab, *Cancer magister*, belongs to a genus which includes in the Atlantic two of the edible crabs of the eastern United States and Canada and the edible crab of Europe. On the Pacific coast there are

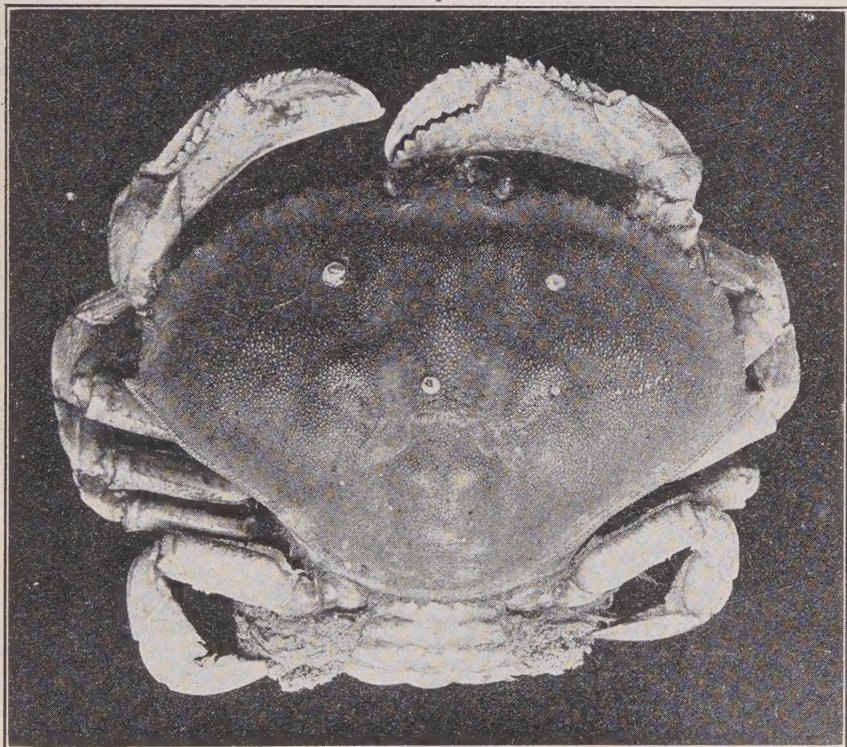


FIG. 3. Edible crab. *Cancer magister*. Egg-bearing female, one-half natural size. San Francisco, California.

nine species of *Cancer*, but most of these are so small or so rare that they need not be considered. Three or four species are large enough to be used for food but only *Cancer magister* is both large enough and abundant enough to be of commercial importance and is the only

*California State Fisheries Laboratory, Contribution No. 14.

species recognized by the protective laws. The following descriptions and figures should serve to distinguish these larger and more closely related forms.

CANCER MAGISTER. EDIBLE CRAB.

Size large, sometimes reaching nine inches in breadth across the back from point to point. The general color of the living animal is not reddish and there is no red on the lower side; the teeth on the front and side of the shell are low and saw-like, those between the eyes are not all of the same size, and the two nearest the eyes are larger and more widely separated from the middle three; the "hand" of the large pincer has conspicuous rows of spines; the "fingers" are not black-tipped; and the last joints or "claws" of the walking legs are slightly curved, broad, thin and fringed with hairs forming swimming paddles. Seldom found between tides but usually in from one to twelve fathoms on sandy bottoms.

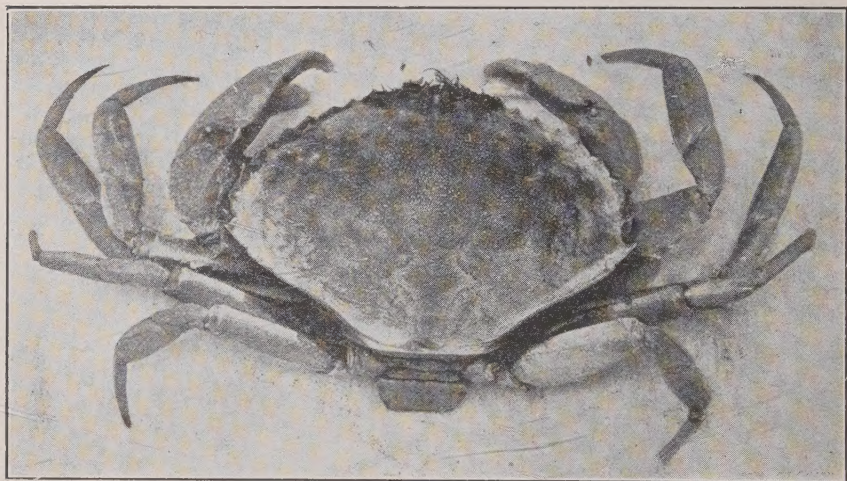


FIG. 4. Slender crab. *Cancer gracilis*. Male, natural size. Monterey Bay, California. The last joint of the last walking leg on the right is missing.

CANCER GRACILIS.

Size small, seldom exceeding three inches. General color of the living animal and teeth on margin of shell much as in *C. magister*; the "hand" is rather less spiny and the "fingers" are also not black-tipped; the last joints of the walking legs are long, curved, slender and hairless, thus differing from all the other species here described. In California not found between tides but in deeper water, usually on sandy bottom.

CANCER ANTENNARIUS. ROCK CRAB.

Size moderate, seldom exceeding five inches. General color of living animal reddish, lower side with small red spots not found in other species; teeth on front and sides of shell heavy, projecting and curved forward, those between the eyes much as in *C. magister*; the "hand" is large and entirely smooth, the "fingers" are conspicuously black-

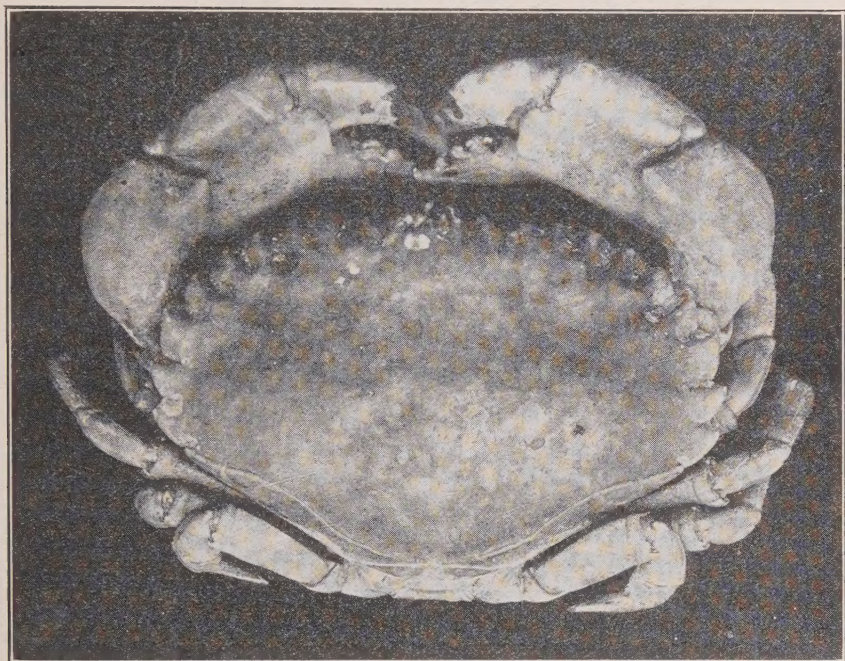


FIG. 5. Rock crab. *Cancer antennarius*. Male, two-thirds natural size. Monterey Bay, California.

tipped; the last joints of the walking legs are stout, nearly straight and hairy. Commonly found among rocks between tides, though also in deeper water.

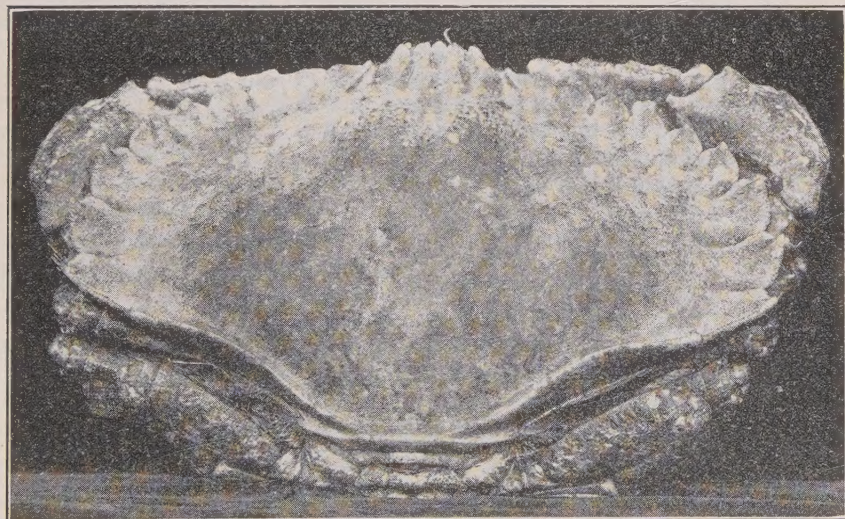


FIG. 6. Rock crab. *Cancer productus*. Male, one-half natural size. Monterey Bay, California.

CANCER PRODUCTUS. ROCK CRAB.

Size moderate to large, reaching seven inches. General color in life as in *C. antennarius* though there are no small red spots on the lower side; teeth on front and sides of shell similar to those of *C. antennarius*, those between the eyes of about equal size and projecting forward in front of the eyes thus differing from all the other species here described; the "hand" is roughened but without distinct spines; the "fingers" are black-tipped; and the last joints of the walking legs are straight and hairy but not flattened. Found usually between tides among the rocks though sometimes in deeper water.

THE PROPOSED INVESTIGATION OF THE SARDINE.*

By WILL F. THOMPSON.

The marvelous development of the sardine fishery in California warrants close attention to it and its prospects of permanency. The sardine has indeed become the most important species among the many utilized in our great fisheries. In 1914 few were canned, but each year has seen steady increase in number of canneries and in the total packed. It is well nigh impossible that this giant industry which has grown up over night should continue to grow at the rate it has in the past, but an increase is surely still to be expected. It is a growth unparalleled within the countries bordering the Pacific, and its effects are consequently well worthy of attention. This attention is especially due from the state, which has legal jurisdiction over the fisheries and is responsible for their continuity. But such observation, it should be carefully noted, is as much for the prevention of hasty and harmful legislation as for conservation.

Moreover, many of the unsolved questions of fishery science and many of the practical questions concerning the course of the annual "runs" of fish may expect at least partial answers from an energetic investigation of the life history, as has been previously pointed out by the writer in Fish Bulletin No. 2 and in CALIFORNIA FISH AND GAME, Vol. 5, No. 2. The trend of the program of investigation, practical as it is, is therefore aimed at a solution of "purely scientific" questions as well as more "practical" and immediate ones.

In order that this program may be formally on record and that it may be open to discussion by anyone, it is hereby published in the form of the principal questions which it seeks to answer. Suggestions and criticism are earnestly desired from every possible source.

The law requiring this work is as follows:

It shall be the duty of the fish and game commission to gather data of the commercial fisheries and to prepare the data so as to show the real abundance of the most important commercial fishes; to make such investigations of the biology of the various species of fish as will guide in the collection and preparation of the statistical information necessary to determine evidence of overfishing; to make such investigations as will bring to light as soon as possible those evidences of overfishing as are shown by changes in the age groups of any variety of fish; to determine what measures may be advisable to conserve any fishery, or to enlarge and assist any fishery where that may be done without danger to the supply.

*California State Fisheries Laboratory, Contribution No. 15.

1. Will depletion occur?

To answer this we must have:

- A. The catches by each boat, their character and the artificial limits affecting them, in order that comparisons may be made of the catches of the various years, and of the seasons.
- B. The type of each boat and the apparatus used.
- C. The method of the fishery, and the effects of such factors as the moonlight.
- D. A knowledge of any decided changes in method or location of the fishery.
- E. An answer to the following question, No. 2.

2. Are there great natural fluctuations in abundance, or quality, other than those of depletion?

An answer requires:

- A. The same data as are required to answer No. 1.
- B. The composition of the catches each year according to size or age, in order that we may discover whether a good catch is due to an exceptional spawning season. This implies a knowledge of the effect of selective fishing on the catch.
- C. The variation in the composition of the catches during various parts of the year, so that we may be sure we are comparing the years correctly.
- D. The spawning season, and its relation to natural changes in quality or local abundance.

3. Is it possible to foretell fluctuations?

This can not be done unless we know:

- A. What changes are invariable each year, such as the spawning migration.
- B. What the success of each spawning season is, as evidenced by the abundance of the youngest fish. It may be necessary to judge of this by comparing the abundance of the youngest in separate classes, such as medium or large fish.
- C. What the age and rate of growth is, so that we may know how long it takes for the fish of a given spawning season to become fit for use.

4. Do sardines migrate from one region to another?

This question is of importance because of the possible difference in food value of sardines which live in the various regions; because of the possible depletion of one region independently of another; or because of the possible dependence of the supply in one region upon the sardines in another.

The data required are:

- A. Extensive measurements to discover any physical differences between schools from different regions. For example, a difference in size of the head would indicate that the schools did not mingle but were independent.

- B. The early life history, especially that of the eggs and their drift with the currents.
- C. The location of the various age classes of fish at the different periods of the year, so that seasonal migrations may be discerned, and the simultaneous character of fluctuations in different regions may be discovered, if existent.
- D. The accessibility of the schools under various physical conditions, to explain any absence which might erroneously be assigned to migration.

5. If depletion should occur, what measures for protection should be adopted?

For the proper solution of this problem, an intimate knowledge of the life-history is necessary, but the following will constitute the most practicable basis for action:

- A. Are the sardines in different regions independent? May one region be depleted and another not?
- B. When are the sardines worth least as food? When are they most valuable to the species as spawners?
- C. Upon what classes of fish does the strain of the fishery fall most heavily?

In answering these questions it is obvious that extensive data must be gathered. We are undertaking the collection of careful statistics regarding the boats and their catches, and are observing the sardines closely throughout their season. This implies the obtaining daily of material from the canneries and fishermen. We trust that this privilege will be cheerfully granted, and the agents of the Commission have been instructed to use the utmost care that no unnecessary inconvenience is put upon any person or firm in the pursuit of duties required of them by law.

THE LIFE HISTORY OF THE SAGE HEN.

By E. H. OBER.

The sage hen is the largest upland game bird found in California. Consequently it is not easily confused with any other bird. As a prominent zoologist has said, "It is not particularly necessary to describe the sage hen any more than the elephant, as its size and its extremely long and pointed tail proclaim its identity anywhere."

The high open plateaus from six thousand to twelve thousand feet in elevation constitute its home, the birds seldom frequenting country where timber grows to any extent. As a rule, sage hens do not migrate from their accustomed locality, no matter what the weather conditions may be. When snow covers the ground they resort to high brush which protrudes through the snow, where it is possible for the birds in severe blizzards to dig or scratch down to the ground at the base of a bush. At such times when the snow is deep and frozen, sage hens fall easy prey to the marauding coyote, lynx, skunk, and various other varmints that follow their scent each winter.

During clear spells throughout the winter sage hens keep on the go searching for food that has been blown over the snow. Strange as it may seem, at such times birds are the very wildest of any time during the year.

Early spring usually finds the birds poor in flesh and shabby in plumage. The females select the sunny slopes and hillsides, near springs or small running streams, for nesting grounds. A feeble attempt at building a nest is made by scratching out a shallow hole in the ground at the foot of a sage bush, or other shrub. Here the eggs are laid, the usual number being about ten. In color, they are greenish and speckled with brown; in size they are about that of a small domestic hen's egg. Old male birds never frequent the locality in which their mates nest and only return when the young birds have reached maturity. The percentage of their brood brought forth each year by the nesting hens is exceptionally good considering the immense disadvantage the birds are subjected to during their nesting period. By this I mean varmints of all sorts, early spring floods, trampling by sheep, cattle, and horses, and last but not least, the man with the gun, who formerly was always to be found following the snow back as it receded from the lower hills. Many young birds fall early prey to varmints, as the parent bird has feeble means of protecting herself or her young.

While the sage hen is nesting, and for a short while after the female comes off with her brood, the food consists mainly of the tender buds and leaves of blue brush, and wild cherry brush. After the young birds have learned to fly, they descend along the larger streams, also frequenting meadowlands, where small, tender weeds and young grasses are added to their diet. At such places the young birds will gather in large flocks and when approached by man, will stand and crane their necks and make a very faint attempt at cackling. When closely approached they usually run rather than fly.

By the last of August or early September the young birds are usually joined by the old male birds, which come off the higher slopes and ridges. These old male birds stay very high up all summer long, quenching their thirst from the snow banks.

The cock sage hen's performances in early spring are most interesting. He struts very much like a turkey, his long pointed pheasant-shaped tail spread out like a fan. The wings trail beside him, the breast nearly rubbing the ground. In some instances the breast does rub the ground, and the feathers are worn off. During the courting antics the male inflates his saffron-colored air-sacs on both sides of the neck and makes a guttural sound, stepping much as does our turkey gobbler. All of this performance is apparently directed to attract the attention of the females, which gather together old and young, big and little.

The sage hen is by nature terrestrial; flying at best is a laborious performance and only resorted to as a last expedient. With much effort a bird lifts itself, but when once in the air it flies rapidly, and I have seen them sail for two miles or more before alighting. Sage hens are not suspicious birds. They generally walk or run away from an intruder, sometimes hiding among the sage bushes, where, owing to their protective coloration, it is quite difficult to detect them without a bird dog.

In October, sage hens congregate in large flocks, and feed almost entirely on sage and soon lose their gamey flavor brought with them from their higher homes.

The principal diet of the sage hen throughout the year consists mainly and almost exclusively of sage and a great portion of bitter brush, along, however, with a certain amount of flower buds and bulbs. It is about the only bird known that can eat with relish, and benefit, the leaves of our common sage brush, and subsist upon that food indefinitely. In fact, there are various kinds of herbage that sage hens are known to pick up during certain seasons of the year aside from sage, but such only in very small quantities.

The sage hen is one of our grandest game birds, a bird that should be carefully guarded to prevent extinction. The young birds are often alert and rise from the ground at some little distance at the approach of man on foot or horseback. If the hunter marks them carefully when they alight he has no trouble in walking within easy shooting distance. When flushed, the sage hen almost always flies behind the hunter making a turn in the air just after leaving the ground, thus making it a large and easy target. Like most of our ground birds it does not fly from cover at the crack of a gun.

The writer recalls about twenty years ago when thousands of sage hens made their homes in Long Valley, which is in the south end of Mono County and just northwest of Inyo County's north boundary line. At that time it was considered mere play for the cowboys to dash with their saddle horses into a large flock of sage hens, one thousand or more, and strike down two or three with their quirts or cow whips before the birds could possibly get out of the way. Conditions now, however, have changed. Of the thousands which a few years ago inhabited our plateaus, now only a few scattered hundreds remain. Indeed, the situation regarding the future welfare of the sage hen throughout California was most alarming until the stringent laws of recent years became effective.

NOTES ON THE LIFE HISTORY OF THE BLACK-TAILED DEER.

By J. D. COFFMAN.

Though the black-tailed deer, *Odocoileus columbianus*, is well known and widely hunted, yet its habits and life history are but imperfectly known. We therefore offer the following notes, which have been compiled in connection with a report sent the California Fish and Game Commission by the Trinity National Forest, as a contribution to the life history of this notable game mammal.

With the heavy snows on the higher ranges, the deer descend to the lower elevations and during the winter feed on such bunch grass and browse as is available, utilizing moss, mistletoe and branches broken off by snow where the more palatable forms of forage are unavailable. During this period of the year the deer travel in bands. As the snows melt away they follow the snow line back to the higher ranges and during May and June scatter out through the mountains. During the spring they feed on open glades, but after the middle of June most of the deer ascend to the higher slopes, feeding on tender shoots and grasses during the early summer, and almost exclusively on browse, such as hazel, oak and various species of *Ceanothus* (blue brush, buck brush, wedge-leaf (chaparral), and white-thorn), from early August until the acorns are ripe in the fall. Then mast forms a large proportion of their food within the oak country. In the fall, after the rains have come, deer will also dig for roots and ground shoots, and feed extensively on the edible fruiting bodies of certain species of fungi that develop abundantly in the timber at that season. During the summer season deer use natural mineral springs and salt licks extensively.

It is noted after extremely cold and snowy winters that a few deer appear to die from the effects of the storms, deer so dying being found late in the winter or in the early spring after they have commenced feeding on the open grass lands. For this region (the Trinity National Forest) the rutting season begins early in November and ends about the middle of December, depending a great deal upon the altitude where the deer happen to be feeding, the mating beginning several weeks earlier in the lower elevations than at the higher altitudes. On the lower lands within the watershed of the north fork of the Eel River, in the southwestern portion of the Forest, the rutting season begins about one month earlier than the general season stated above.

It is a common belief among the old residents that the first heavy storm during November has considerable influence upon the rutting season. This may, however, simply be due to the fact that these storms appear usually about the time the deer start to run, and the impression may also be due to some extent to the fact that the tracks are so much plainer in the snow that it creates the impression the deer have been running more, and it is probably true that the deer would move around more after the advent of snow even aside from the rutting season.

During the running season the bucks frequently fight each other, and many of the old ones have torn ears from their horned encounters with their rivals. The bucks at this time become thin, as a rule, and

the meat is usually unfit for food even though the buck may appear to be in good condition.

The young are born during the months of May, June and July. The does first breed, therefore, when they are approximately eighteen months old. In their first breeding season they bear but one fawn as a rule, and very often but one during the second season, but thereafter bear two fawns, and in rare instances three. Until such time as the fawns are able to follow the does, they are hidden away in a brush patch or sheltered nook, while the mother feeds near by, returning to them at intervals during the day. After the fawns are able to travel, their beds or hiding places are changed frequently until such time as the fawns are able to follow throughout the day. During the first six weeks the fawns are said to have no scent, the scent glands probably not having developed as yet. This undoubtedly protects them materially from their predatory enemies. Even with this protection, probably not as many as fifty per cent of the fawns reach maturity. Most of the fawns have lost their spots by September and are weaned during the fall. The fawns usually remain with their mother until they are yearlings or until the next fawns are born, and frequently stay with her even for several months longer.

The bucks shed their antlers during January and February. During March they have only a skin covering over the old scar, and the new antlers begin to grow in April. During the months of June, July and August the antlers are in the velvet and are tender, so that the bucks remain in the open timber or around rocky places, and do not frequent brush areas. During the latter part of August and the first half of September they rub the velvet from their horns. About November 1 the bucks' necks begin to swell, and they do considerable traveling around just previous to the rutting season.

The summer coat of all the deer is of a reddish color, and the winter coat is of a bluish-grey color and is heavier than the summer coat, the hair being longer. The winter coat is shed during May, and the summer red is worn until September, when the winter coat begins to come in again. Occasionally a white or albino deer is seen or killed, and also black deer, both being rare varieties of the common local species.

During the latter part of August and the month of September most of the deer range at high elevations and lie in heavy brush thickets as a protection against flies, and perhaps to escape hunters and their other enemies as well.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

Sent free to citizens of the State of California. Offered in exchange for ornithological, mammalogical and similar periodicals.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

January 15, 1920.

"Game laws are not enacted for the purpose of depriving any citizen of his rights, but rather to prevent such deprivation by assuring a supply."

FIVE YEARS OLD.

CALIFORNIA FISH AND GAME is now five years old. If you are not aware that it has grown in size, compare the first issue with the recent trout number. But physical growth is not everything. We trust that there has been a growth in the so-called "general tone" of the magazine as well. It is to be hoped that each issue acts more and more as an evangel of conservation and that the material presented increasingly convinces the reader that California's wild life resources are worth something and consequently need to be conserved.

CALIFORNIA FISH AND GAME was started as a means of moulding public opinion, for it was believed that: "The effectiveness of game protection is governed by the interest of the people and the spirit of those who hunt and fish." To judge of its effectiveness in this regard is perhaps difficult, but it is certain that there has been a growth of public opinion favoring the protection of wild life resources, and we believe the magazine has helped in this development.

You will find in the volumes completed noteworthy facts concerning the status of fish and game in California and the means being taken to conserve it. The magazine has acted primarily in an educational and publicity capacity, but it also constitutes a record of activities and accomplishments which are of historical value.

In looking toward future numbers what more can we do for the cause? Our magazine has not entered the field of the sporting magazine. Articles seldom appear in story form and the usual hunter's experiences recounted in characteristic fashion are omitted, and for that reason it may not be so readable. The adherence to scientific fact, however, should carry added importance to the reading matter, even if popular and light reading is lacking. It should be remembered that the function of our magazine is quite different from that of a typical sporting magazine.

If CALIFORNIA FISH AND GAME is not living up to its motto "Conservation through Education," let us immediately receive a set of protests from our readers.

WE MUST CAPITALIZE OUR RESOURCES.

More and more we are awakening to the fact that fish and game propagation and protection is a business proposition. One of the most convincing arguments for the conservation of wild life resources is to be found in the attractiveness of fish and game to sportsmen outside of the state, who benefit the state by spending large sums of money in obtaining their sport. It is up to us to capitalize all of our resources—climate, mountain scenery, forests, fish and game. When capitalized it does pay dividends. These dividends, however, continue only when fish and game are properly conserved. Had a sufficient breeding stock of that most valuable of all the fur-bearers, the sea otter, been maintained the state would now be obtaining a return from a splendid industry. The practical extinction of this valuable fur-bearing animal precludes any return. With a little foresight California can so conserve its supply of wild life that it will form a permanent and paying attraction to the pleasure seeker. With a little indifference California can become bankrupt so far as invested capital in natural resources is concerned, with no hope of solvency.

EDUCATION VERSUS LAW ENFORCEMENTS.

Since the beginning of the educational campaign in this state to establish a public sentiment favorable to fish and game conservation, we have continually pointed out

the advantages of the educational method over that of force. The necessity of a patrol force is largely due to the lack of proper public sentiment. The most fundamental way of cutting down the number of violations is to let people know something about the wild life of the state and its needs.

State after state is coming to a realization of just these facts. New York is doing some splendid educational work, Michigan has been devoting a great deal of energy to an educational program, and now we note that Wisconsin has begun an extensive program of education and has been employing speakers to deliver lectures throughout the state. The results have been so much worth while that an enlargement of the program is planned. According to the Wisconsin Commission "it is the one thing that will save the wild life of the state and the work must be pushed vigorously. Until such time as the people become educated to the importance of a united public sentiment for conservation we must pursue the course of warrants, courts and fines and follow the old method of educating with the sledge hammer, teach through force instead of reason and the more rigid the laws and the more severe the fines, the more potent the effect."

FUR RESOURCES ENDANGERED.

That it is high time each state turned its attention to giving judicious protection to fur-bearing mammals is evidenced by the following statements given in a recent *Farmers' Bulletin* (No. 1079) of the United States Department of Agriculture:

"Recently the supply of peltries has been decreasing at an alarming rate. Raw-fur buyers representing all parts of the country place the decrease at from 25 to 50 per cent during the last ten years. There are no longer any virgin trapping grounds. Even in Alaska the two most important fur-bearing animals, the beaver and the marten, have become so nearly exterminated that they are now being protected by a close period.

"Laws protecting fur-bearing animals are designed to keep a steady flow of peltries coming to market year after year, thereby bringing trappers a reliable income and giving regular employment to thousands of people engaged in dressing skins, manufacturing garments, and distributing them through the various avenues of trade.

"A general protest comes from raw-fur buyers against traffic in unprime skins.

The losses caused by killing fur animals when their pelts are not prime are enormous. An educational campaign is greatly needed to prevent this waste and to perpetuate our fur-producing resources."

NEW GAME FISH IMPORTED.

On November 24, 1919, the California Fish and Game Commission received a shipment of ayu eggs on the steamer *Shinyo Maru* from Japan which were sent through the courtesy of Professor C. Ishikawa, College of Agriculture at Komaha, near Tokyo (Tokyo Imperial University), Japan.

The eggs were deposited on cocoanut fiber and placed in four jars holding about a gallon to a gallon and a half of water each. There were also three tubs about thirty inches in diameter which contained approximately three to four pieces of fiber each. The ayu eggs are very small, not much larger than the eggs of the shad. As soon as the consignment arrived in San Francisco the eggs were hurried to the Brookdale Hatchery and were placed in the hatching troughs at that place, where they are at the present time. Upon arrival the eggs were apparently all dead but since this Commission is very anxious to give this experiment a thorough test every precaution was taken in the handling and placing of the eggs in the hatchery troughs in case any life should develop.

The Commission feels greatly indebted to Dr. David Starr Jordan of Stanford University, who originally corresponded with the Imperial University at Komaha near Tokyo, and it was through his efforts that the shipment was received. The ayu is a sporting fish belonging to the trout family and it will make an excellent fish for the anglers. It reaches a length of 8½ inches; none are to be found in this country.—E. D.

CALIFORNIA FURNISHES STRIPED BASS TO HAWAIIAN ISLANDS

On Saturday, November 15, 1919, the California Fish and Game Commission shipped about 2500 striped bass from 2½ to 5 inches in length to the Fish and Game Commission of the Territory of Hawaii to be planted in streams in the vicinity of Honolulu. Captain H. E. Foster of the patrol launch "Quinnat" had charge of the seining crew which col-

lected the fish on the Benicia flats by means of a beach seine 270 feet long, 12 feet deep, the bag of which was $\frac{1}{2}$ inch mesh and the wings $1\frac{1}{2}$ inch mesh. It took about three days to make the catch.

The fish were held in live cars until sufficient were collected to make the shipment and then were put aboard the Matson Navigation Company's steamer "Maui." Here the fish were distributed in six large salmon tierces that had been arranged on the main upper deck in front of the office of the chief engineer, Alexander Ryan, who took personal charge of the fish on the trip. Each tierce had salt water circulation by means of a small pipe which had been connected up with a pump in the engine room.

In 1874 California received the first shipment of 150 small striped bass from New Jersey. These fish were distributed in the Sacramento and San Joaquin rivers. In 1882 a second shipment of 400 striped bass were sent to this state by the United States Bureau of Fisheries. California has an annual catch of about 1,500,000 pounds of striped bass, with a commercial value of about \$150,000. Since so fine a result was obtained with a small number of fish in California the large plant of 2500 fish in the vicinity of Honolulu should assure the rapid establishment of this splendid fish in the Hawaiian Islands.—E. D.

STREAMS NOW STOCKED WITH GOLDEN TROUT.

The angler who visits the Southern Sierras during the next few years will be elated to discover the streams teeming with Golden Trout. Heretofore the "most beautiful trout in the whole world" was limited to a few high mountain streams in the vicinity of Mount Whitney, and the angler was forced to take a long hard pack trip in order to secure this trout. Now, owing to the operations of the California Fish and Game Commission the golden trout is to be found in mountain streams from the southern boundary of the Yosemite National Park to the tributaries of the Kern River.

In the beginning Golden Trout were caught with hook and line and then transported by mule pack train to other streams which were to be stocked. Now the fish are spawned and the eggs hatched at the Mount Whitney hatchery and then dis-

tribution is made. During September and October of this year large plants of golden trout have been made in the headwaters of the Kings River, thus extending the distribution of this fish over fifty miles to the northward. Former plants had already extended the distribution more than one hundred miles to the northward. Every effort is being made to extend the range of this notable trout, care being taken, however, to keep a pure strain by planting in barren waters. As results of former plantings have been very successful, it is expected that golden trout will be available to everyone within a few years, and that the lakes and streams of the southern Sierras will be the Mecca of anglers the world over.

IN MEMORIAM. OSCAR H. REICHLING.

It is with deep regret that we record the death of Oscar H. Reichling, Cashier of the Fish and Game Commission, which occurred on Sunday, November 9, 1919.

Mr. Reichling was appointed a special deputy on October 24, 1903, while living at Jackson, Amador County. Impressed with the frequent flagrant violations of the laws protecting wild life, particularly by the foreign element, Reichling saw that unless the laws were enforced that it would be only a short time until there would be no game or fish. As a citizen, he did what he could to stop the violations, but found that he was handicapped by not having authority to make arrests. He corresponded with Chas. A. Vogel-sang, who was then Chief Deputy, and through him received an appointment. While acting as a special deputy, he made an excellent record and when, with the advent of the Hunting License Law, it was possible to employ more regular deputies, because of his record, he was given a permanent appointment, March 24, 1908, with headquarters in San Francisco.

As Mr. Reichling was exceedingly painstaking and accurate and had early training as a bookkeeper, it was found that he could best be used in this capacity and he was detailed to assist the late Judge E. G. Heacock, then in charge of the license and book-keeping department. Upon the death of Judge Heacock, in 1909, he was again promoted. Later he was given the very responsible position of cashier, the place he held at the time of his death.

Mr. Reichling is survived by his wife and mother and also by three brothers and sisters. He was a member of Excelsior Parlor, N. S. G. W., and is mourned by a host of friends.

—J. S. H.

SAVE KLAMATH LAKE BIRD RESERVATION.

California today is one of the greatest out-of-doors states in the union. Its mountains, lakes, forests, rivers and wealth of bird life attract people from every state in the country. Every man, woman and child in this state owes Theodore Roosevelt something for his far-sightedness and for his efforts in saving the wild birds of the state. They not only owe something in the way of a cash contribution to a memorial for his far-

Klamath Lake reservation. Here was a wide, open, shallow alkaline lake ten or twelve miles long. For miles and miles around the border was a vast tule marsh, white with the nesting multitudes. The beauty of Lower Klamath Lake was in its life, the flying birds that hovered over the wide, treeless area, the calling flocks that from time immemorial have held this as their own. Around the wide border of the lake a wild swamp grass grew, nurtured by sub-irrigation, and a great number of cattle were raised here.



FIG. 7. Lower Klamath Lake, a federal bird reservation, from the west shore of the lake. An abundant tule growth on the east side of the lake forms an especially fine breeding ground for waterfowl and the islands in the lake are used as breeding grounds by cormorants, pelicans and great blue herons. Photograph by H. C. Bryant, June 9, 1914. (Neg. 1269, Calif. Mus. Vert. Zool.)

sightedness, but they owe some effort toward saving these greatest living and useful monuments which he preferred to any other kind.

Although Lower Klamath Lake is a federal wild bird reservation by special proclamation and wild birds are carefully protected by both state and federal law, yet the vital defect in the whole situation is the present unfortunate condition which is bringing about the destruction of bird life on a vast scale and the annihilation of this great reservation by the drying up of the lake. The myriads of ducks, geese, wading birds and other wild fowl are at home in the wonderful marsh land, but they can not exist on the alkali flats of the desert.

Picture to yourself the condition a few years ago when Roosevelt created the

Then came the land operators and wildcat schemers and advocated the drying up of the lake by cutting off its water supply from Klamath River. They said instead of a marshy waste we could have a great farming area. A dyke was built and a change has gradually taken place. Instead of the waters, we now have desert flats crusted with alkali. The meadows of wild grass owned by stockmen about the lake have reverted to the desert because of the lack of water. The great tule marsh, as dry as tinder, and the peat two or three feet below the surface, was set on fire last spring and is now a gigantic waste, flaming in some places and slow burning under the surface in others. The migratory flocks that have fed and nested here are flying about without homes and resting places.

A. P. Davis, director of the reclamation service, has written Senator Chamberlain that a recent investigation of the marsh lands around Lower Klamath Lake has failed to disclose positive evidence of their value for agricultural purposes. According to his own words "very little conclusive evidence can be found as to the agricultural value of the lands around Lower Klamath Lake."

Here is the most useless piece of destruction of one of our greatest out-of-

rest on migrations? It is of the utmost importance that public waters be preserved, if we are to maintain duck shooting."

So says the American Game Protective Association with reference to the drainage of Big Rice Lake in Minnesota under the pretext of land for the farmer.

So say we all of us with reference to the Klamath Lake Bird Reservation and other wildcat schemes which threaten the extermination of our wild life resources.



FIG. 8. Nests of pelicans and cormorants on Bird Island, Lower Klamath Lake. Photograph by H. C. Bryant, June 8, 1914. (Neg. 1276, Calif. Mus. Vert. Zool.).

door resources, and nothing gained. The whole thing can be remedied if the reclamation service will open the dykes and let the water back into Lower Klamath Lake. Every citizen of the state should take this matter up with the reclamation service, our senators and representatives in Washington, or with the Secretary of Agriculture. If immediate action is secured Klamath Lake Reservation could be restored and would remain as a great living monument to Theodore Roosevelt.—W. L. FINLEY, *State Biologist*, Portland, Oregon.

THE HUNTER'S LAMENT.

"Of what earthly use is it to protect waterfowl from overshooting and then take away their nesting grounds, their feeding waters and the places where they

SOUTHERN CALIFORNIA FISHERIES FILMED.

In order to inform the people of the state as to the wonderful fisheries which have been developed in Southern California the past few years, the Fish and Game Commission has recently had a film made depicting the outstanding features of the tuna fishery. After spending many days aboard the launch "Albacore," of the Fish and Game Commission, the camera man secured a very fine series of pictures showing the methods of capturing the fish. Visits to the canneries helped to complete the film for here the whole canning process was photographed. In the film, therefore, one may view the entire process from the capture of the fish at sea to the finished canned product. Outstanding features of the film are a scene at Smug-

gier's Cove showing the fishing fleet at anchor, secured after a rough and dangerous landing, and scenes showing a barge being loaded with tuna.

This new film forms a part of the free film service furnished by the Fish and Game Commission. Many splendid films showing wild birds and mammals in their own homes are available through the Fish and Game Commission's educational and publicity department.

SEVEN GRIZZLIES FORMERLY EXISTED IN CALIFORNIA.

Now that the grizzly bear is extinct in California careful studies are being made of the material at hand to find out how many varieties of grizzly bear actually existed in this state.

Dr. C. Hart Merriam has published a review of grizzlies and big brown bears of North America (U. S. Dept. Agric., North American Fauna, No. 41, Feb. 9, 1918) in which it is pointed out that seven varieties of grizzly bear were formerly found in this state. The California coast grizzly formerly ranged in humid coast regions from San Francisco Bay south to San Luis Obispo. The Tejon grizzly was found in the dry chaparral hills of interior coast ranges, between the San Joaquin Valley and Los Angeles. The Sacramento Valley grizzly was limited to the Sacramento (and perhaps San Joaquin) Valley and adjacent foothills. In extreme northern California, along the Klamath River, ranged the Klamath grizzly, while further

south in Mendocino County was to be found the Mendocino grizzly. The largest one formerly occurred in the Santa Ana, Cuyamaca and Santa Rosa mountains of southern California. Still another variety roamed over the southern Sierra Nevada, this one being called the Henshaw grizzly. The Southern California grizzly was the largest of all the grizzlies, even larger than the great buffalo-killing grizzly found on the Kenai Peninsula in Alaska. It was of such a huge size that the weight of a male is estimated at 1400 pounds. The height at the shoulder from flat of foot of one specimen measured 4 feet. The sole of the largest foot, without claws, measured 12 inches in length and 8 in breadth. The length of an old female taken in Trabuco Canyon near Santa Ana measured 6 feet 3 inches.

Material collected by the United States Bureau of Biological Survey made possible this paper, which describes eighty-six different varieties of grizzly and brown bears, a large number of which are newly described varieties. Skins and skulls in the California Museum of Vertebrate Zoology at Berkeley were used in the studies made by Dr. Merriam.

WHEN ARE GREENHEADS MOST ABUNDANT?

A recent article by Aldo Leopold in the October number of *The Condor*, entitled "Differential Sex Migration of Mallards in New Mexico," brings up the mooted question as to whether female

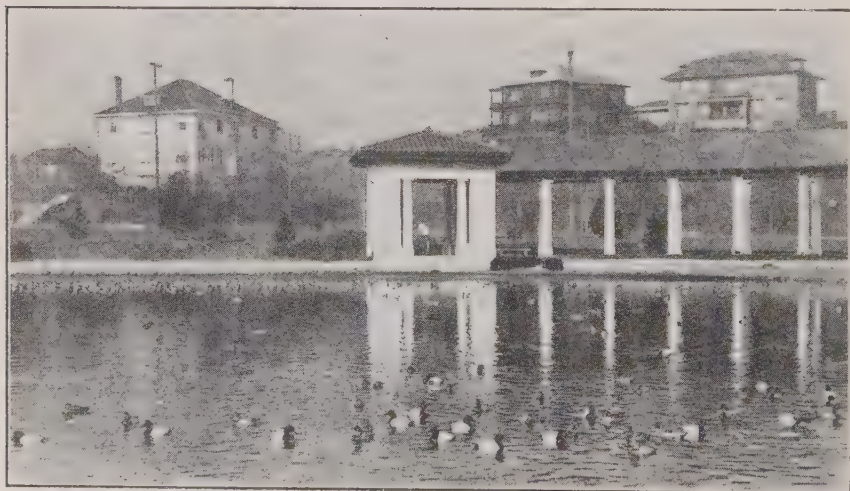


FIG. 9. Canvasbacks on Lake Merritt, Oakland, the first game refuge established in California. Photograph by H. C. Bryant, December 27, 1918.

CALIFORNIA'S GAME SANCTUARIES.

California is assuring a perpetual supply of game by setting aside areas where no hunting is allowed and where game is allowed to breed unmolested. The state is responsible for the creation of most of them, the federal government for others. Certain areas known as game refuges have been set aside by legislative enactment. Others known as state game preserves have been created by the Fish and Game Commission after the owner of the property has ceded all hunting privileges to the state for a period of not less than ten years. The federal government has set aside five bird reservations and protects all of the wild life within the national parks and national monuments. As a consequence game is now absolutely protected on nearly 3,000,000 acres within the State of California, an area roughly equivalent to three per cent of the total area of the state.

GAME REFUGES.

Name	County	Area, acres	Estab- lished
1A -----	Siskiyou -----	8,960	1917
1B -----	Modoc -----	57,000	1917
1C -----	Modoc -----	47,560	1917
1D -----	Trinity -----	64,000	1915
1E -----	Shasta -----	69,000	1917
1F -----	Lassen -----	47,580	1917
1G -----	Tehama -----	34,400	1917
1H -----	Plumas -----	31,000	1917
1I -----	El Dorado -----	64,000	1917
1J -----	Amador -----	57,600	1917
1K -----	Fresno -----	33,400	1917
1L -----	Tulare and Kern -----	37,600	1917
2A -----	Mendocino and Lake -----	37,000	1917
3A -----	Santa Cruz -----	3,400	1915
3B -----	San Benito and Monterey -----	13,760	1909
3C -----	Santa Barbara -----	39,680	1917
3D -----	Ventura -----	125,440	1917
4A -----	Los Angeles -----	600,740	1915
4B -----	Los Angeles -----		
4C -----	Orange -----	76,160	1913
4D -----	Riverside -----	69,120	1917
4E -----	San Diego -----	51,840	1917
Mount Tamalpais	Marin -----	28,000	1917
Lake Merritt	Alameda County (Oakland) -----		1869

STATE GAME PRESERVES.

No. 5 -----	Monterey and San Benito -----	8,570.57	1916
No. 6 -----	Santa Barbara -----	42,000	1918
No. 7 -----	Santa Barbara -----		

FEDERAL BIRD RESERVATIONS.

Klamath Lake	Siskiyou -----	*22,400	1908
Clear Lake	Modoc -----	*1,600	1911
East Park	Colusa -----		1909
Farallon Islands	Pacific Ocean, near San Francisco -----		1909
Goat Island	San Francisco Bay -----	141	1916

*Approximate.

NATIONAL PARKS AND MONUMENTS.

Parks—			
Yosemite -----	Tuolumne and Mariposa -----	719,622	1890
Sequoia -----	Tulare -----	161,597	1890
General Grant -----	Fresno and Tulare -----	2,536	1890
Monuments—			
Lassen Volcanic -----	Shasta, Lassen, Plumas and Tehama -----	79,561	1916
Muir Woods -----	Marin -----	295	1908
*Pinnacles -----	San Benito -----	2,080	1908

*Included in State Game Refuge No. 3B.

ducks migrate southward earlier than the males. According to the article female mallards are most abundant in the Rio Grande Valley near Albuquerque during October. By November the preponderance of females is diminished and by December first there is a preponderance of males. The proportion of males and females is about equal among the mallards wintering in the region. The article furthermore points out that a number of ducks banded at Great Salt Lake in Utah have been taken in New Mexico.

It may be that sportsmen in this state can gather evidence which will support or refute the statements made.

CALIFORNIA'S FIRST GAME REFUGE.

Splendid publicity has recently been given the first game refuge established in California through the publication of an article entitled "Wild Ducks as Winter Guests in a City Park," in the National Geographic Magazine for October, 1919. The article is by Joseph Dixon, of the University of California Museum of Vertebrate Zoology, who made a careful study of the bird life on Lake Merritt, almost in the heart of the city of Oakland, and took many splendid photographs of the birds. Lake Merritt was set aside as a state game refuge in 1869, and therefore has the distinction of being the oldest refuge in the state. That the refuge is fulfilling its mission is evidenced by the great flocks of waterfowl which frequent its waters and the surrounding lawns each winter. Furthermore, the number of birds appearing is on the increase, showing that it is being utilized as a safety zone by more and more birds each year. This may in a measure be due to the systematic feeding carried on by the city of Oakland. No visit to Oakland in the winter is complete without an investigation of this bird sanctuary which so well testifies to the worthwhileness of setting aside areas where hunting is prohibited.

PROTECT THE WOOD DUCK.

Fortunately the duck most nearly exterminated in this state is one which can be readily recognized by a peculiar rolling flight quite unlike the flight of any other duck, and by a long, square tail that gives it a different outline and appearance. It

possesses iridescent colors and the male has conspicuous markings. Furthermore, it practically never flocks with other ducks. There is no excuse, therefore, for killing this duck, which is protected by both state and federal laws looking towards its ultimate retention as a member of our fauna.

FISHES IN RELATION TO MOSQUITO CONTROL.

The United States Bureau of Fisheries in a recent publication (U. S. Bureau of Fisheries, Document No. 874) tells of investigations to determine the effectiveness of fishes in eradicating mosquitoes. Experiments were made with various species of small fish, and while it was found that some varieties, such as sun fish and gold fish, destroyed the mosquito when confined in small aquaria, they were of little value in large bodies of water where other food was obtainable.

However, by a series of experiments it has been found that the *Gambusia affinis* (Baird and Girard), or top minnow, can be made of practical value in the control of the mosquito pest. Investigations showed that this fish is especially suitable for antimosquito work because it seeks its food at the surface, where the mosquito and its larvæ are found; it is very prolific, giving birth to well-developed young and therefore requiring no special environment for egg culture; and it thrives in areas especially suitable for the support of mosquito larvæ. But experiment also showed that the top minnow must be protected from larger fish, bass especially, its chief protection being the presence of shallow water; and that there are some instances where the top minnow can not be used against the mosquito because the mosquito sometimes breeds in water so badly polluted that the top minnow can not live therein, as in a particular instance of water polluted by chemicals.

The results of the experiments indicate that the top minnow, when planted under proper conditions, completely eliminates mosquitoes, provided the waters are kept free from protective vegetation, such as slightly submerged leaves and stems, or growths which form a floating mass; and that even though protective vegetation exists, the top minnow greatly reduces the number of mosquitoes, the number of fish

required for eradication depending largely, of course, upon the condition of the water with respect to protective vegetation.

BIRD PROTECTION IN ENGLAND.

A committee of the Royal Society for the Protection of Birds has recently investigated the present English laws and has suggested many changes looking toward the reconstruction of the Wild Bird Protection Acts. It is pointed out that there are numerous defects and obscurities in phraseology which have added largely to the complications which have arisen in the working of the six interdependent acts. The law has not been enforced in any general or habitual manner and has failed to protect the rare birds of the country.

The report gives first of all a historical review of bird protection laws in Great Britain, a digest of the present laws with the offenses and penalties, results of the present law, the proposed new law, and international law. Among the recommendations are the setting up of two schedules in the place of one, the general closed season to be from March 1 to September 1. Owners and occupiers are to have power to kill or take birds on their land during the closed season, with the exception of the birds listed in the schedules. Listed among the game birds on schedule A with an open season each year are such birds as the skua, black-throated diver, night jar, peregrine falcon, wood lark, woodpecker and wryneck. On the other hand, among the birds on schedule B which are given total protection are such birds as the avocet, Kentish plover, golden eagle, osprey, spoonbill and most of the owls.

The committee further recommends increased educational work, stating: "In order to protect birds both worker and child must know a little about them. Information regarding their characteristics and habits must be circulated. Bird and arbor schemes or their equivalent must bring light and air into the whole elementary school system. We should be glad to see a Bird Day, devoted to lectures, become a regular feature of the program of every school in this country."

THE FISHING INDUSTRY IN CALIFORNIA.

California in 1915 ranked second among the Pacific Coast states in the number of

persons engaged, in the value of its investment, and in the amount and value of its fishery products. There were 4,282 persons engaged in the shore fisheries, 551 in the vessel fisheries, 35 in vessels transporting, and 3,584 persons engaged on shore in canneries, etc., making a total of 8,452 persons connected with the fisheries, as compared with 5,530 in 1904. The increase can be traced mainly to the shore industries.

The total investment in the fisheries of the state amounted to \$5,824,263, showing an increase of nearly 55 per cent since 1904. The items making up this total are 73 fishing vessels valued, with their outfit, at \$354,375; 20 transporting vessels with a value, including their outfit, of \$72,000; 1,429 gasoline boats valued at \$1,351,110; 1,169 other boats valued at \$104,816; apparatus, in the shore and vessel fisheries, valued at \$606,944; shore and accessory property with a value of \$2,731,390 and working cash capital amounting to \$448,809.

The products of the fisheries of California in 1915 aggregated 93,338,703 pounds, with a value to the fishermen of \$2,506,702. This is an increase of about 44 per cent in quantity, but a decrease of about three-fifths of 1 per cent in value as compared with 1904. Among the items in the products of special importance may be mentioned 7,303,933 pounds of chinook salmon, valued at \$340,949; 21,024,190 pounds of albacore, or tuna, valued at \$316,103; 6,923,563 pounds of flounders, valued at \$209,766; 375,774 pounds or 53,682 bushels, of eastern oysters, valued at \$165,573; 4,952,692 pounds of salted cod, valued at \$161,695; 1,784,488 pounds of striped bass, valued at \$146,928; 4,344,254 pounds of rockfishes, valued at \$146,216; 892,392 pounds of spiny lobsters, valued at \$130,119; 1,414,155 pounds of crabs, valued at \$124,870, and 5,761,929 pounds of sole, valued at \$108,252.—*Bureau of Fisheries, Document No. 875.*

A CALIFORNIA FOX FARM.

Messrs. Lewis and Kierman, of Nevada, have started a fox farm near Pomin's, on the shores of Lake Tahoe. Six of the best silver black foxes obtainable have been purchased from Prince Edward Isle, at a cost of over \$9,000. Four large fox pens

of reinforced heavy poultry wire have been built, each equipped with a strong house for shelter and with runways to the ground. The accompanying picture (Fig. 10) shows the favorite male fox, a little over two years of age, which produced fourteen pups on his second breeding. This fox cost \$2,100 and his fur is



FIG. 10. Silver gray fox. A valuable animal imported from Prince Edward Island for use at a newly established fur farm at Lake Tahoe. Photograph by J. Sanders.

exceptionally fine. Messrs. Lewis and Kierman expect to raise furs for the market, and it is rumored that other parties from Nevada intend starting a fox farm in the spring, also to be located in the Tahoe region.—J. H. SANDERS.

HOW MANY SHOOTERS IN THE UNITED STATES TODAY?

Prior to the war it was estimated that we had at least five million sportsmen in the United States. Men in a position to know claim that this year the total will be increased at least one million and possibly more. Many of the boys who before their experience in the army had never fired a gun, will not be satisfied now without their share of the sport.—*Illinois Sportsman*, Nov. 13, 1919, p. 3.

OWNERSHIP OF WILD LIFE.

"Wild life is the property of all the people," says the *Conservationist*. No one attempts to deny this, and least of all the game violator. From his point of view it is not only the property of all the people, but is more particularly the prop-

erty of him who can get it. The more remote the locality where the law is violated, the more deeply rooted is the idea that the game is there to be taken, regardless of law, and without much feeling of moral obliquity. The violator has a strange feeling that some sort of justification is on his side, though the law may be on the other. The point of view is that of early colonial times, before the state had reason to assert its ownership—when, indeed, game was the property of any one who could shoot straight enough. It is the point of view of an extreme individualist.

Game is still the property of everyone. But, whereas originally the people placed no restrictions upon the use of that property, they have now thrown about it safeguards that are vital for its continued existence. Every citizen has a vested interest in every individual bird, animal and fish, and is defrauded, if the game is taken in any way contrary to the established rules. The point of view of the man who respects the law, and insists upon respect for it in others, is that of collective ownership. His individual right to take game is dependent upon consent to do so from others.

The feeling of collective ownership is still only partly developed. The tendency to wink at violations still decreases as the sense of common ownership of wild life is strengthened.—*The Sportsmen's Review*, Nov. 15, 1919.

THE WARDEN OF GAME.

"The game protectors are the people's appointed representatives in protecting what is the people's own property. Their task is a hard one, but they are doing it well. From year to year, the force is constantly developing in efficiency and effectiveness, and its members are responsible for the conservation of natural resources of untold value. They perform work of the highest public importance and their efforts are deserving of the people's unqualified support and commendation."—*The Conservationist*, May, 1919.

MUSKRAT FARM ESTABLISHED IN OHIO.

The price of furs has continued to rise until the lowly muskrat, which our fathers sold for 10 cents a pelt, now brings about

\$1.50. It is not surprising, therefore, that an enterprising man in Port Clinton, Ohio, has purchased 160 acres of marsh land along the river which he expects to turn into a muskrat fur farm. The fact that the bodies of the animals will bring about 25 cents increases the possibility that the project will be a success.

CANADA URGES PROTECTION OF GAME.

One of our two species of swans, a curlew and a crane, are in the gravest danger of extermination now and other species will follow unless everyone helps to keep our promise to protect these migratory birds. Man has exterminated species of birds; but not in all time can he replace a species. A species evolved through millions of years, with its marvelous adaptations to meet its needs, its wonderful beauty or power of flight, can be exterminated by man and disappear from this earth utterly and forever or it can be protected and live on, reproduce its kind, and be a delight and a source of knowledge to man, who may in some distant, wonderful time unravel some of the mystery of its origin which points back to the dawn of life, and to the Creator of all.

—Dept. of the Interior, Ottawa, Canada.

NEED FOR DOE PROTECTION OBVIOUS.

A pitiful sight that ought to carry an eloquent message to every sportsman who has killed or who may be tempted to kill a doe, was met with by two hunters on October 4, 1919, in Bear River Canyon, about eight miles above Colfax, Placer County. The sportsmen came upon a doe which had the appearance of having been dead two, or perhaps three days, judging from the condition of the carcass and by the hoof tracks of the animal that had been made previous to a light rain that had fallen the day before. The deer had evidently traveled some distance, after having received a bullet in the lower bowels, before she fell.

The lingering death, due to poor marksmanship, in itself appeals to one's sympathy, aside from the fact that the law

had been violated; but that is the smaller part of the real tragedy of that lone mountain wood. The doe was a mother, and surrounding her remains were the tiny tracks of her fawn. The doe's bag



FIG. 11. A reason for the protection of does. Doe, mother of a fawn, killed by law violator. Photograph by E. M. Muse.

still contained milk, and the udders were pink, as though the fawn had nursed, or attempted to do so, up to or after the mother had died.

What became of the little fawn? Like many others that have been orphaned under similar conditions, it perhaps remained beside its unresponsive mother until it fell an easy prey to coyotes; for, not far away from the dead doe, on the dry sand bar at the edge of the river, were the unmistakable stubby-toed dog-like tracks of a large coyote.

It is to be hoped that such instances as this will serve to carry a story home to that brand of *imitation* sportsmen who shoot without care or conscience.—EDWARD M. MUSE, Sacramento, California.

FACTS OF CURRENT INTEREST.

Several San Pedro canneries are paying \$155 cash per ton for albacore. Five years ago this variety of fish sold at \$40 a ton. In 1918 it was \$60 to \$90 a ton. Now the fisherman receives \$155 per ton. Previous to 1910 albacore could not be given away and tons upon tons were carried to sea to feed the sharks.



Owing to the federal law prohibiting the sale of waterfowl and owing to the aggressive enforcement of the federal migratory bird law, very few illegal shipments of ducks have entered San Francisco during the present open season.



Striped bass fishermen report splendid fishing in the San Francisco Bay region, but the take by commercial fishermen has been below normal.



The Red River Lumber Company recently pleaded guilty to a violation of the water pollution laws and paid a fine of \$200. The company has taken proper means to prevent further sawdust pollution.



The Fish and Game Commission has ordered a new patrol boat for use in patrolling San Francisco Bay and vicinity. The boat will be thirty-one-foot over all with seven-foot beam equipped with a twelve-horsepower engine, and will be seaworthy in every respect.



Signs that the sardine industry is growing are evident in the recent canning operations of F. E. Booth and Company, at Pittsburg. Sardines caught outside the heads at San Francisco are being canned at the Pittsburg cannery. Although subject to some delay in reaching the cannery, they are said to arrive in splendid condition.



The establishment of a fur farm at Lake Tahoe and the proposed establishment of another in the same vicinity forecasts the beginning of the fur farming industry in California.



During the months of October and November, 1919, Deputy John Burke and Special Deputy Herbert Leahy made 57 arrests in San Mateo County, the fines totaling in all \$1,210; 38 of these arrests, with fines amounting to \$810, were made by Deputy John Burke, and 19 arrests with fines amounting to \$400 by Special Deputy Herbert Leahy.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

MANY FISHING BOATS DESTROYED.

For the second time in recent years great damage has been done to the fishing fleet at Monterey because of the lack of proper shelter for the fishing fleet. On Thanksgiving Day, 1919, ninety-two power boats were washed ashore at Monterey. Nor does this include lighters, nets and other gear, and damage done to docks and wharves. The estimated loss to the fishermen alone will run close to \$150,000. A further severe loss will be suffered by the cannery, as sardines are plentiful at this time and there will be but a few boats to fish for them.

In England and other European countries the government improves small harbors purposely for the use of fishing smacks. It is apparent that our own government in making surveys and plans for the improvement of harbors should take into consideration the need for refuges for fishing fleets. A breakwater which

would give proper shelter for the fishing fleet at Monterey is needed, and there are many small bays along our coast which should be improved and made into harbors for fishermen's boats.

**FISHERMEN'S UNION AT
FORT BRAGG.**

During the spring of 1919 the Fishermen's Union at Fort Bragg established and operated their own plant for mild curing the salmon catch. Steep hillside property on the Noyo River was purchased and a 60 by 80-foot shed erected. It was necessary to grade about 800 feet of roadway on the steep hillside to connect the shed with the highway. The construction and grading work was done by the fishermen, most of the labor being donated. By agreement, Small & Urie canned the small salmon for the Union, the Union packing over half the total catch of nearly 3,000,000 pounds, so that



FIG. 12. Monterey fishing fleet piled on the shore after a severe storm on the day before Thanksgiving, 1919. Photograph by Heidrick.

the season at Fort Bragg has been unusually successful compared with other coast points.

Encouraged by this season's success, the Union has completed plans for next year at Fort Bragg which include an addition to the Noyo River shed to accommodate a two-line cannery, ice plant and cold storage plant and the building of a mild curing house at Shelter Cove. The proposed cannery will not only handle the small salmon but also pack sardines, which are plentiful in the Fort Bragg and Shelter Cove region.

NEWPORT BAY FISHERIES BEING DEVELOPED.

With work progressing on the breakwater at Newport Bay, Newport bids fair to become one of the important fish shipping points in Southern California. The residents of Newport and Balboa are united in an effort to develop their fisheries asset to the utmost. Already a fish packing plant is under construction and a substantial bulkhead has been built for the accommodation of boats and markets.

Newport is one of the principal smelt shipping points in California, a normal day's shipment consisting of from four to twelve tons of these fish. With the improvement work now under way the scope of the fisheries at Newport will be enlarged greatly. Already a number of fishing boats are planning on making Newport Bay their home port.—C. S. B.

FISHING VILLAGE COMPELLED TO MOVE.

The Pacific Electric Railway Company has served notices on the fishermen and other residents of Port Los Angeles ordering them to vacate their premises on or

before January 1, 1920, and already the removal of this picturesque fishing village is under way. The above company has also filed a petition with the State Railroad Commission asking permission to abandon service to Port Los Angeles. It is claimed the wharf is in a rickety condition and that traffic does not justify continued service to this point. It is planned to remove the wharf at once if permission is granted.

The village at Port Los Angeles was established in 1905 by H. Sano and Dick Tododie, two fishermen, and at one time contained approximately two hundred men, women and children dependent upon the fishing business. As high as ten thousand pounds of fish has been unloaded at the wharf in one day by fishing boats operating off Port Los Angeles; but with the development of the fishing industry at San Pedro most of the fishing boats left for the latter port. As a result the amount of fish received over the wharf has decreased until today a normal day's shipment from Port Los Angeles consists only of approximately fifteen hundred pounds. There are still about sixty Japanese and Russian fishermen engaged in fishing at Port Los Angeles and all of them are planning on moving to other points in the near future.

The wharf at Port Los Angeles was constructed twenty-eight years ago by certain interests who planned on making this point the port of entry to Los Angeles. When built it was over five thousand feet long, but damage by storms four years ago caused the removal of about two thousand feet of the pier. It has always been one of the popular piers for anglers who still refer to it as "Long Wharf." During the runs of mackerel, corbina and

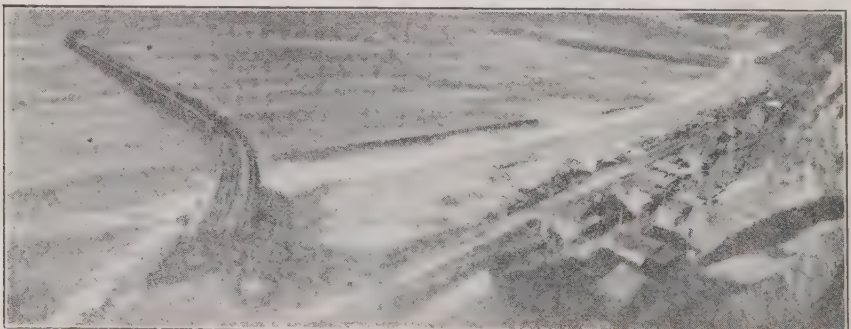


FIG. 13. Wharf and picturesque fishing village at Port Los Angeles, which is being moved by order of the owners of the land. Photograph by C. S. Bauder.

pompano, approximately four hundred rod and reel sportsmen could be counted fishing from the wharf.—C. S. B.

SEAPLANES TO LOCATE FISH.

It has generally been known for many years that many sea birds are dependent on their eyesight to locate their food while flying over the water. So what is more natural than for seaplanes to locate schools of fish in the same manner? Needless to say the fish cannery of San Diego, who have been somewhat alarmed at the continued absence of sardines which have been appearing in large numbers elsewhere on the Pacific Coast, rejoiced at the suggestion of this idea.

Definite arrangements have now been made with Lieutenant Lincoln, the naval commandant in charge of operations at the Naval Air Station at San Diego, whereby regular seaplane flights will be undertaken by the navy aviators to look for schools of fish. The first flight will take place on December 15 and they will continue to patrol each day any certain portion of the sea that is desired by the cannery.

When a seaplane sights a school of fish it will wire back to Rockwell Field from where the information will be telephoned to the Fish and Game Commission office at San Diego for distribution to the several canneries. A submarine chaser always hovers in the vicinity of a flying plane so as to be near in case of an accident. So it may be that the news can be sent to the nearby fishermen the quicker by means of the wireless on these boats.

While these flights may not be of so much value in winter because of the roughness of the weather, they will later on prove of much material benefit to all parties concerned when the larger fish are running. They will also settle the fact of whether certain schools of fish are running in those portions of the ocean further out than the present small fishing boats go, as the seaplanes have a four hundred mile radius of operation. It may thus be the beginning of continued prosperity to all canners and fishermen in this section as well as of aid in the investigation work of the Fish and Game Commission by showing routes, locations, and migrations of different fishes.—L. H. H.

AGAR-AGAR TO BE MANUFACTURED IN SOUTHERN CALIFORNIA.

After two years of diligent research, Mr. C. Matsuoka of Los Angeles has effected an improved process for converting several species of the common marine algæ found on the Southern California coast into agar-agar, and plans are under way for the construction of a thirty-thousand dollar plant at Tropic, California, where this product will be manufactured on a commercial scale. When completed this plant will have a capacity of approximately one ton of dried seaweed per day, and its operation will mark the beginning of a new industry in the United States. Experiments which have been carried on by Mr. Matsuoka demonstrate that agar-agar of a much superior quality to the imported article can be produced from our native seaweeds.

There are approximately fifteen species of marine algæ found on the California coast which may be used in the manufacture of agar-agar. Among the varieties found in sufficient quantities for commercial uses are: *Gelidium corneum*, *Gelidium cartilagineum*, *Gracillaria confervoides*, *Euchema spinosum*, and various species of *Tenax* and *Gigartenea*.

Practically all of the world's supply of agar-agar is produced in China, Japan, Ceylon, and Malaysia. During the year 1919 there were two hundred and forty tons of agar-agar shipped to the United States from Japan where the manufacture of this product has reached the proportions of an important and well established industry. In the latter country only ten species of seaweeds are found which are used in its manufacture.

It is prepared for the market in two ways. One method consists in drying and bleaching the thallus of the algæ in the sun. The other method consists in making a jelly of the seaweeds, allowing the water to freeze out and cutting the residue into thin strips and drying thoroughly. The American Agar Company intends to use the latter method.

Agar-agar is one of the most useful products obtained from seaweeds. It is used in the manufacture of vegetable isinglass, capsules, candy, paints, and culture media for bacteriological research. During

the European war it was successfully employed in the treatment of war wounds. It is supplied to the drug trade commercially in dry, transparent crystals that are reduced to a coarse powder for medicinal use. It has the natural property of absorbing water and retaining it; and in

medicine, the additional property of resisting the action of intestinal bacteria and of the digestive enzymes. It is prepared by boiling and may be eaten with milk or cream, or mixed with any of the ordinary cereal foods with the addition of salt or sugar.—C. S. BAUDER.

NOTES FROM THE STATE FISHERIES LABORATORY.*

By WILL F. THOMPSON and ELMER HIGGINS.

THE INAUGURATION OF SCIENTIFIC WORK ON THE SARDINE.

The past quarter has seen the inauguration of a definite program of investigation of the sardine. This species has become the most important to our commercial fisheries, and it is necessary that we learn something concerning its habits and that we have as detailed a knowledge as possible of the course of the fishery. A resume of the program will be found in another part of this magazine (p. 10).

In order that desired results may be obtained, Mr. O. E. Sette, formerly stationed in Long Beach as collector, has been transferred to Monterey, where he will observe the sardine run throughout its season, under the direction of Mr. Thompson.

To date (November 28), the sardine run in Southern California has not really begun, only very small fish being in evidence. The shortage in cans has, however, been the only hampering factor at Monterey.

SOME RECENT FISHERY PUBLICATIONS.

A publication of the United States National Museum has recently appeared, describing the guano birds of Peru. As Dr. R. E. Coker, the author, states, "Peruvian guano is indirectly but obviously a product of fish. The birds in this case fulfill a function comparable to that of the American factories that convert fish into fertilizer." He also says "a quantity of more than 10,000,000 tons of high grade guano is reported to have been extracted from the Chincha Islands between 1851 and 1872." The pictures accompanying the report are remarkable,

showing the great numbers of birds on the nesting places. The paper should be of great interest both to those interested in birds and those interested in fish.**

Dr. R. E. Coker has also another recent publication to which attention may be called, namely that on the "Fresh-water Mussels and Mussel Industries of the United States." These mussels are used for button-making in an extensive industry. The bulletin deals with phases of the industry and describes the species, although it does not review the excellent work which has been done in recent years on the strange life history of these mussels, for the most part by employees of the Bureau of Fisheries.†—W. F. T.

A SNIPE-FISH FROM CATALINA.

The president of the Tuna Club of Catalina Island, Mr. J. A. Cox, gave the undersigned a very small fish, with a long snout, which he said had been picked up on the beach at Avalon. This fish proved to be identical with the *Macrorhamphosus hawaiiensis* described by Dr. C. H. Gilbert from near Laysan Island, as taken by the United States Bureau of Fisheries steamer "Albatross." A figure of this species may be seen in Volume 23, Part 2, of the Bulletin of the United States Bureau of Fisheries. According to a recent review of the species of the family, the form found in the Hawaiian Islands is the same as a species taken in East Africa, the Indian Ocean, China, and the Medit-

**Habits and Economic Relations of the Guano Birds of Peru, by R. E. Coker. Proceedings of the United States National Museum, Vol. 56, pages 449-911. Plates 53-69. Document No. 2298.

†Fresh Water Mussels and Mussel Industries of the United States, by R. E. Coker. Bulletin of the Bureau of Fisheries, Vol. 36. Document No. 865.

*California State Fisheries Laboratory, Contribution No. 16.

erranean, namely *Macrorhamphosus veli-taris* Pallas.†

If this is true, the species is very widespread indeed. The writer has not had the opportunity of comparing specimens from these various localities, hence it is not possible to state positively that this species is in reality the somewhat cosmopolitan one mentioned above. That from Catalina was compared directly with the type of *Macrorhamphosus hawaiiensis*. This is a new and most interesting record for our Pacific Coast, this form not being an active swimmer as most recently found "visitors" are.—W. F. T.

THE "RUNNER" FISH IN LOWER CALIFORNIA.

Mr. Gilbert Van Camp of the Van Camp Sea Food Company has in his possession a mounted specimen of the "Runner" of tropical seas, *Elagatis bipinnulatus* (Quoy and Gaimard). It was taken at Cape San Lucas, Lower California, during the spring months of 1919, while its owner was engaged in operating a cannery in Lower California.

This is, in so far as the writer is aware, the sole record of this species from the western coast of North America, although known from the East Indies, the West Indies, Hawaii, India, and occasionally north as far as Long Island on the eastern coast of the United States.

The species may obviously be expected some time to put in an appearance on the coast of Southern California. It is one of those species commonly supposed to be widely distributed, although specimens from different regions have not been closely compared to make the fact certain.

It is to be recognized by the long dorsal and anal fins and by the presence behind each of a detached finlet containing two rays. It belongs to the same family of fishes as does our common yellow-tail (*Seriola*), namely the Carangidae.—W. F. T.

THE OCCURRENCE OF THE JAPANESE HERRING.

IN CALIFORNIA FISH AND GAME for April, 1918, page 4, Professor Starks of Stanford University, in reviewing the herrings and herring-like fishes of California, briefly describes and gives an illus-

tration of the Japanese herring, *Etrumeus microps*. He says in part: "The Japanese herring is a common species in the Hawaiian Islands and in Japan. Specimens have been taken at San Diego, and a few years ago two specimens were sent to Stanford University from that locality with the statement that it was not rare in certain seasons. It should be looked for and its appearance and abundance reported to the State Fish and Game Commission."

A specimen of this species was taken with the sardines caught November 3, 1919, by the boat "Maru," near San Pedro, according to Mr. E. M. Nielsen of the San Pedro office of the Commission. The specimen was forwarded to the laboratory and proved to be the Japanese herring. It resembles the sardine closely enough to be difficult to distinguish, and its appearance may be frequent despite its apparent rarity.—W. F. T.

DEEP SEA "MONSTER" CAPTURED.

Among the strange fishes taken in the fine-meshed nets used on the boat "Albacore" for the collection of young fish, there is none more bizarre in appearance than the great-mouthed ferocious looking little monster, *Idiacanthus antrostomus*, Gilbert. This fish is about three inches long, jet black in color, and of slender worm-like form. A row of luminous spots are placed on each side, supposedly supplying light, for at the depth normally inhabited by this fish, there is little light. The head is large, the eyes small, and the mouth enormous, bristling with fang-like teeth of assorted sizes.

This species has only been recorded by Dr. Gilbert in 1890 as taken off Catalina Island at a depth of 603 fathoms. Our specimens were taken May 6, 1919, at night in but 20 fathoms, one near Catalina and one about 90 miles off shore, near Cortez Bank. Other closely related species have been taken, one in the mid-Atlantic from a depth of 2750 fathoms, and one from off the Chilean coast from 677 fathoms.—E. H.

MEXICAN FISHES IN CALIFORNIA PORTS.

One of the finest food fishes to come into Southern California ports during the last season was the Spanish mackerel,

†See Regan Annals and Magazine of Natural History, (8) 13, p. 17.

Scomberomerus sierra, which was brought to San Diego from Mexico during October in considerable quantity. These fish are rarely taken as far north as San Diego, but are said by fishermen to be plentiful on the Mexican coast, a considerable distance north of Cerros Island.

Two beautiful specimens sent us by Mr. Helwig of the San Diego office of the Commission, are of interest because of the arrangement and number of orange spots on the sides of the fish, which are more numerous than in any description of the species, and are arranged in about 18 or 20 diagonal rows.

Mr. Neilsen, statistical assistant at San Pedro, informs us that a cargo of these fish was also brought to that port during the summer.—E. H.

FIRST APPEARANCE OF THE "CRESTED BAND-FISH."

On July 25, 1919, a rare and beautiful fish was brought to the laboratory, of so strange a form that it proved quite a curiosity to fishermen and others. The

purplish tints on the head. The eye is large and placed low; the mouth is small and armed with many small bristle-like teeth; the fins are bright red, the dorsal extending from the head to the tail. The first ray of the dorsal fin is produced, forming a high crest about eighteen inches long. Unfortunately it was broken in making the capture, but was said to bear several membranous streamers which were red like the fins.

This is the first specimen which has fallen into the hands of naturalists in America. Indeed, probably not more than a dozen specimens have ever been taken, and its rarity makes its occurrence in California well worthy of note. The species was first described by Professor Giorna, of the Academy of Turin, in 1803. Like many other pelagic fishes, it is evidently very widely distributed. It has been taken at various other places in the Mediterranean, at the Cape of Good Hope, and in New Zealand. Single specimens of the same or very closely related species

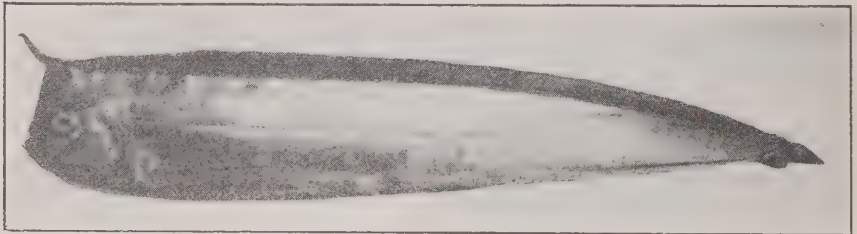


FIG. 14. Crested band-fish, *Lophotes cepedianus*? Taken in the surf at Long Beach, California, July 25, 1919. Photograph by V. E. Pearl.

specimen was found to be a species of *Lophotes*, probably *L. cepedianus*, Giorna, the "crested band-fish." The fish was found swimming feebly in the breakers at Long Beach and was caught by a couple of passers-by who waded into the surf and seized it in their hands. It was taken to a photographer by Mr. V. E. Pearl, where the accompanying photograph (Fig. 14) was made, and the fish was then given to us.

The fish is long and much compressed, being about four feet long, eight inches deep, and only one and three-eighths inches wide. The skin is smooth, without scales, except for a single row against the dorsal fin, and of a bright silvery color with

have also been taken near the Madeira Islands and in Japan. None of the specimens have been taken in the fish's natural habitat which is said to be moderate depths in the open sea, but all have been cast ashore in a greatly enfeebled or damaged condition.

Several species of *Lophotes* have been described but the material for study has been so slight—a single specimen in most cases—that it is entirely doubtful whether more than one or two species exist. Our specimen differs in some respects from the current descriptions of any of the supposed species, but it seems likely that it belongs to the first named, *L. cepedianus* of Giorna. Nor is the relationship of the

family well understood. Dr. Jordan, in his "Guide to the Study of Fishes," remarks, "It is thought that the *Lophotidæ* may be related to the ribbon fishes, *Taeniosomi*, but on the whole they seem nearer the highly modified *Scombroidei*, the *Pter-*

acridæ, for example." Thus our fish is placed in the group of mackerel-like fishes which contains such peculiar forms as the pomfret, the dolphin fish, the luvax, and the square-tail—all previously recorded in CALIFORNIA FISH AND GAME.—E. H.

CONSERVATION IN OTHER STATES.

NEW YORK ENFORCES CONSERVATION LAWS.

In a recent New York case a violator of the game laws was held in \$1,000 bail and later paid a \$500 fine. The fact that nothing but the highest commendation, because of the amount of these sums, has been expressed by the newspapers, is an indication of the growing determination of the public to support the conservation laws. There was a time when case after case of this character was thrown out of court, or sentence suspended, largely, it would seem, from lack of a full comprehension of the basic principles underlying the conservation law; but the striking contrast of recent cases disposed of shows that all over the land there is an awakening interest in game conservation and a determination to see that the game laws are enforced.—*The Conservationist*, Vol. 2, p. 94.

PROTECTION OF SOCKEYE SALMON.

There was signed at Washington on September 2, 1919, a treaty between the United States and Great Britain, having for its object the protection and rehabilitation of the sockeye salmon in the contiguous waters of the State of Washington and the Province of British Columbia. The protection accorded the salmon under this treaty is such as was determined to be necessary by the International Fisheries Conference which held hearings in Washington and British Columbia in 1918.

MINNESOTA AUCTIONS

CONFISCATED GEAR.

The official bulletin of the Minnesota Game and Fish Department shows a photograph of a part of the accumulated paraphernalia confiscated during the past three years. The picture shows nets and traps of all kinds and a row of more than a hundred and fifty guns and rifles. The

property was disposed of at public auction on August 1 and 2, 1919, the net proceeds accruing from the sale amounting to \$2,592.70.

VIRGINIA FAVORS NEW TYPE OF REFUGE.

Instead of setting aside well stocked areas as game refuges, the State of Virginia is planning some game preserves. Owners of tracts from 200 to 400 acres in each of the 400 odd magisterial districts are being sought who will bequeath to the commonwealth exclusive shooting privileges on such tracts. The state will then post the areas and plant thereon mated pairs of quail, which the state will secure from Texas. The quail are to be fed for the first few weeks, but no attempt will be made to keep them within the preserve, on the theory that if they are hunted outside the preserve they will speedily learn the places where they are not disturbed.

MINNESOTA BREAKS RECORD.

During the year 1918 the Minnesota Fish and Game Commission reared 333,792,127 fry and fingerlings. This breaks all records for the state, the output having been about tripled since 1911.

CANADA ISSUES EDUCATIONAL FILMS.

The Ontario government has recently organized the Ontario Motion Picture Bureau for the express purpose of issuing propaganda by means of films. The Bureau now has 200 films, covering 82 different subjects, which are appearing before large audiences throughout Ontario. Of particular interest are two films entitled "Fish as Food" and "Ontario Fisheries." More and more are fish and game resources being advertised by means of films.

LIFE HISTORY NOTES.

FOREST FIRES DESTROY GAME.

The forest fires in the Angeles National Forest during the fall of 1919 were very destructive to game of all kinds. The burned area covers over two hundred thousand acres of the forested canyons and ridges and brush covered hillsides (see Fig. 15).

The carcasses of deer have been found by fire fighters in many places. Gray squirrels and mountain quail have suffered severely.

I have just made a survey of conditions in Pacoima Canyon, and the Little Tujunga and Big Tujunga canyons. In the

and Azusa, where they sought shelter in vain, because the fire swept widely, over the entire brush covered hills of the south slopes of the Sierra Madre Mountains.

It was pitiful to see dozens of mountain quail, gathered around a little pool of water in a canyon, their feathers burned and topknots gone. In dozens of places I came across similar groups.

The greatest menace to game comes from the destruction of food. At this time the seeds had all ripened, and the walnuts, pine nuts, acorns and manzanitas were ready to eat. These have been burned over a wide expanse, and the

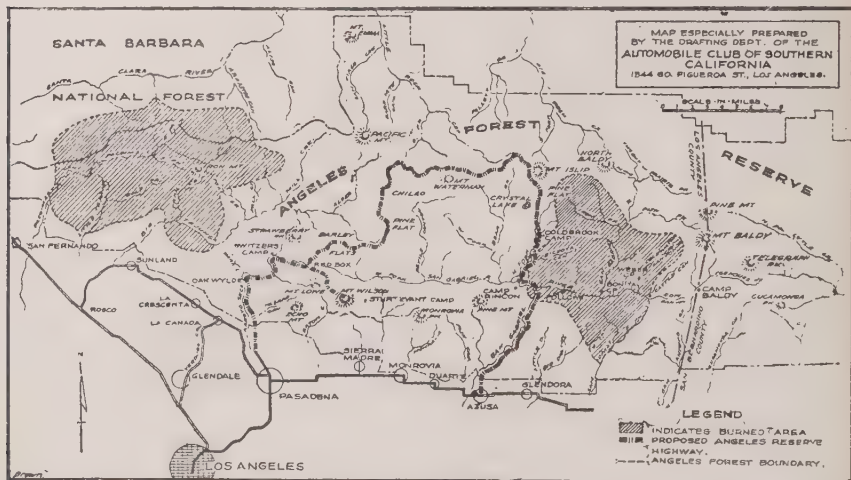


FIG. 15. Map of Angeles National Forest area destroyed by devastating forest fires during the fall of 1919. Severe injury to game was the natural result.

first two, which are outside of, but adjoining the Game Refuge, I saw numbers of dead rabbits, squirrels and mountain quail. Big Tujunga escaped total destruction, as the flames did not cross to the east side.

No doubt most of the game escaped death by flame and smoke, but the destruction of food will lead to widespread famine later. Fanned by a high wind that blew from the desert side toward the sea, the flames in places swept away every bit of vegetation. The game had no choice but to flee before the flames, toward the foothills, near the towns of San Fernando, Sunland, Monte Vista, Pasadena

coming on of winter will make it hard for game to exist.

The recent rains in Southern California fell at a very opportune time, and so gently as not to cause any erosion. Three weeks after the rain the burnt over hillsides were becoming green.

A feature of the destruction of covers for game must not be forgotten. Rabbits and quail, I found, are massing on patches of unburned territory. Overcrowding will result, and hunters will find it easy to kill most of the game in such places. A rancher at the mouth of the Little Tujunga told me that hunters had killed sixty-eight rabbits in a forty-acre field

in a couple of hours on the Sunday after the fire, and seventy-eight the following Sunday.

There is a bright side to the picture: a great deal of food was spared in creek beds. A large crop of quail had been raised and enough will be spared for breeding next season, and the early rains have already sprouted the grass and weeds. The game will be restored in time, but nature lovers and sportsmen should work together to prevent a repetition of these fires by enlisting government, state and county aid, building roads and fire breaks and check dams in the mountains, and reforesting the burnt areas.—CHARLES G. STIVERS, M.D., Los Angeles, California.

DOE WITH THREE FAWNS.

During the latter part of August, the writer ran across a doe with three fawns in the lava bed section of the Modoc National Forest. I was able to come quite close to the animals, which showed little signs of fear. I am quite positive that there were no other deer in that immediate vicinity at that time, as I had been fighting fire close by and had been all around the place where I saw the doe and fawns. I thought it unusual to see a doe with three fawns, especially as the little fellows ranged themselves alongside the doe as if they were perfectly at home and belonged there. I stood looking at the three of them and they at me at a distance of not more than thirty feet for about a minute, the old doe stamping her foot at me; then they trotted off leisurely into the brush.—WM. S. BROWN, Alturas, California.

WILD CAT EATS CHICKENS.

I recently opened up two wild cats (*Lynx eremicus californicus*) to see what they had been eating. In the stomach of one I found the remains of two small Plymouth Rock chickens which must have been caught at least five miles from where the cat was killed, and in the other the remains of three mountain quail.—D. W. MAXEY, Gorman, California.

FOOD OF THE BOBCAT.

The wild cat (*Lynx eremicus californicus*) is still found in numbers here, as indicated by the number being trapped in

the Monterey district of the Santa Barbara National Forest. Wild cats feed on the smaller game animals and birds. I watched one of these animals in his attempts to secure a breakfast last summer. He stole up on a covey of mountain quail, and as he flushed them, got two. I have found feathers of both mountain and valley quail, which investigation proved were left from a feast by wild cats.—H. H. HUNT.

SOUP-FIN SHARK EATS ABALONE.

In July of last year I was fishing for sharks off the bridge at Ocean Beach when the last shark I caught used my last bait (a small perch). I operated on the shark in an effort to retrieve my bait and was surprised to find an abalone out of the shell and apparently still alive, as it seemed to still have muscular action. Anyway I am positive it was taken out of the shell alive and I wondered how the shark accomplished it. The shark in question was a little over six feet long, weighed I judged about 120 pounds, and is what we call sand shark or soup-fin shark (*Galeorhinus zyopterus*).—A. R. MILLER, East San Diego, California.

DOES THE BARROW GOLDEN-EYE BREED IN THE SIERRAS?

The Barrow golden-eye (*Clangula islandica*) is a rare duck in California, there being less than a dozen records for the state. Furthermore, these records show it to be a winter visitant which occurs almost entirely in the central part of the state. However, this duck being a common breeder in the Rocky Mountain district, and having been found breeding in Oregon and Washington, it would seem possible that it might also breed around the higher Sierran lakes. Evidence that this is doubtless true was obtained this past summer. While on a pack trip from Tahoe to Yosemite, Smedberg Lake, in the northern part of the Yosemite National Park, was visited on August 25, 1919. On the lake were a pair of golden-eyes and six young. The adult birds were closely approached, making identification easy. In that no thought was given to the possibility of these golden-eyes being of the rarer species, no attempt was made to ascertain the shape of the white spot between the eye and

the bill. However, as it is very unlikely that the American golden-eye would be found in such a situation during the summer season, it seems reasonable to record the occurrence of the Barrow golden-eye at the above time and place, thus establishing the first record of summer occurrence.—H. C. BRYANT, Berkeley, California.

MEADOWLARKS CONTROL CRICKET PEST.

The State of Washington, with the aid of agents of the United States Department of Agriculture, has been attempting to

control the coulee cricket, which devastates large areas in the vicinity of Adrian, Washington. According to Mr. Max Reeher, scientific assistant in the United States Bureau of Entomology, western meadowlarks appeared in great numbers in the Dry Coulee last fall and began eating the newly hatched crickets. So efficient were these birds in controlling the situation that arrangements for a 1919 control campaign were abandoned. The meadowlarks were almost entirely responsible for the complete cleanup of the area.—A. C. BURRILL, Forest Grove, Oregon.

REPORTS

SEIZURES—FISH, GAME AND ILLEGALLY USED FISHING APPARATUS.

July 1 to September 30, 1919.

Game.

Deer meat	1,424 pounds
Quail	10
Ducks	63
Pigeon	4
Rabbits	51
Deer hides	8
Miscellaneous birds	19

Fish.

Striped bass	1,321 $\frac{1}{2}$ pounds
Black bass	22 pounds
Halibut	5,890 pounds
Catfish	45 pounds
Whitefish	15 pounds
Trout	70 pounds
Salmon	292 pounds
Perch	7 pounds
Barracuda	250 pounds
Crabs	267
Lobsters	127
Clams	457
Clams	675 pounds
Dried shrimps	3,500 pounds
Abalones (dried)	150 cases
Abalones	47
Nets (illegal)	2

Searches.

Illegal fish and game.....	13
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CALIFORNIA FRESH FISHERY PRODUCTS—COMPILED BY DEPARTMENT OF COMMERCIAL FISHERIES.
JULY, AUGUST, SEPTEMBER, 1919.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake.	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Sutter	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexico
Albacore								18,170					126	2,045,882	12,224,470	
Anchovy								775	2,458	336,675				21,670	400,780	
Barracuda									7,738	24,057	56,756	616,864	13,714	474,366	1,189,120	127,569
Bluefish								32,840	4,515	211,736					23,011	
Bocaccio	81	117,900								22	18,672	1,331,102	581	156,033	466,931	
Bonito								806							1,506,410	9,568
Carp				225	26,184		1,453	708							28,668	
Catfish				5,323	765		4,018								10,314	
Chili pepper								79,061	337						79,398	
Coalfish								176,147	2,762	1,586					180,495	
Cutlus cod								143,223	18,633	9,890		205			230,097	
Dogfish			308				563	6,320	460	1,050		19,380		203,672	233,756	
Dolphin																
Eels								81,217	79	1,068	2,996	4,192	254		89,306	
Flounder																
Greenfish								29,480	1,309	238		699		665	42,391	
Hake								3,006	663	13,042	4,457	120,476	14,947	116,451	433,298	898,914
Halibut																
Hardhead																
Herring								3,910	10,604	14,312	38	19,458	40	404	49,266	
Kingfish									1,199	91,493	11,956	585,410	11,094	70,523	771,855	4,105
Mackerel																
Martin																
Mullet															109	109
Perch			132				25	3,245	936	1,329		3,417	221	8,169	17,617	
Pike				48			67								115	
Pompano								16	342			1,769		31	2,153	
Rock bass																
Rock fish								248,388	48,757	112,123	571	63,152	4,776	113,661	185,160	
Salmon								1,364,576	14,925	86,091	11,008	108,965	735	33,373	571,509	6,190
			1,884	1,346,809	197,172		1,494,849					10			7,501,763	

[illegible]

CALIFORNIA FRESH FISHERY PRODUCTS—Continued.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Sutter	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexico
Outtle fish								1,570	547	1,337	30				3,484	
Limpets								765					8,850		8,850	
Mussels	210						564				2,036	300	8,425		12,460	
Oysters (shell)																
Eastern No.			482,355												1,470,830	
Oysters (native)			36,494					987,975							36,494	
Snails, sea																
Squid										67,941		79			68,020	
Miscellaneous—																
Frogs (doz.)						10		23			10				23	
Terrapin (doz.)								21							41	
Turtle, sea																82,000

A CORRECTION—In the October issue of CALIFORNIA FISH AND GAME, page 209, in the report on California fresh fishery products for April, May and June, 1919, there was an error in the catch shown for Los Angeles County: The tuna catch was 331,729 pounds and was shown as turbot. The blue-fin tuna catch was 1,659,119 pounds and was shown as yellow-fin tuna.

VIOLATIONS OF FISH AND GAME LAWS.

July 1 to September 30, 1919.

Offense	Number of arrests	Fines imposed
<i>Game.</i>		
Hunting without license.....	54	\$775 00
Refusing to show license on demand.....	1	10 00
Making false statement on application.....	1	20 00
Deer—excess limit—close season—killing or possession.....	31	840 00
Female deer—spike bucks—fawns—killing or possession.....	39	2,160 00
Illegal deer hides.....	15	300 00
Failure to retain head and horns of deer.....	8	425 00
Hunting on posted grounds.....	7	175 00
Fur-bearing mammals—close season—killing or possession.....	4	95 00
Nongame birds—killing or possession.....	3	30 00
Shore birds—close season—killing or possession.....	1	25 00
Cottontail and brush rabbits—close season—possession.....	23	520 00
Wild pigeons—close season—killing or possession.....	4	120 00
Doves—close season—killing or possession.....	11	225 00
Quail—close season—killing or possession.....	26	885 00
Ducks—close season—killing or possession.....	7	155 00
Tree squirrels—close season—killing or possession.....	1	-----
Grouse—close season—killing or possession.....	2	50 00
Total game violations.....	238	\$6,810 00
<i>Fish.</i>		
Angling without license.....	13	\$280 00
Fishing for profit without license.....	18	275 00
Trout—excess limit—close season—taking or possession.....	4	150 00
Trout—taking other than by hook and line.....	1	25 00
Striped bass—close season—sale—underweight—excess limit.....	16	495 00
Black bass—close season—sale—underweight—excess limit.....	2	50 00
Salmon—excess limit—Sunday fishing.....	2	200 00
Crabs—undersized—close season—taking or possession.....	2	40 00
Clams—undersized—close season—excess limit—taking or possession.....	6	150 00
Abalones—undersized—close season—taking or possession.....	3	75 00
Lobsters—under or oversized—close season—taking or possession.....	4	60 00
Dried shrimps—possession.....	8	180 00
Illegal nets.....	5	550 00
Pollution of waters.....	1	200 00
Total fish violations.....	85	\$2,730 00
Grand total fish and game violations.....	323	\$9,540 00

STATEMENT OF EXPENDITURES—YEAR 1919.

Items of expense	June	July	August
General administration	\$2,242 94	\$2,714 57	\$3,037 71
Research, publicity and education.....	334 97	403 29	228 49
Printing	308 81	-----	1,476 71
Fish exhibits	-----	-----	569 58
Game exhibits	-----	-----	-----
Tahoe Camping Ground.....	-----	1,257 71	1,296 17
Mountain lion bounties.....	160 00	240 00	260 00
Lithographing hunting licenses.....	-----	1,440 00	-----
Lithographing angling licenses.....	-----	-----	-----
Hunting license commissions.....	1,573 90	1,396 30	755 70
Angling license commissions.....	2,066 10	1,651 00	453 90
Market fishing commissions.....	7 00	38 50	54 50
	\$6,693 72	\$9,141 37	\$8,132 76
San Francisco district.....	\$6,680 73	\$7,196 73	\$7,480 37
Sacramento district	5,143 76	5,394 08	5,650 36
Los Angeles district.....	2,509 20	2,566 81	2,915 85
Launch patrol	1,435 64	1,069 94	2,393 80
Prosecutions (fish and game).....	82 30	-----	135 00
Crawfish inspection	200 00	122 58	100 00
Winter game feeding.....	-----	-----	-----
Accident and death claims.....	124 04	124 04	284 14
	\$16,175 67	\$16,474 18	\$18,959 52
Hatchery administration	\$1,215 11	\$1,197 91	\$983 65
Mount Shasta Hatchery.....	2,462 24	5,683 06	6,029 26
Klamath Station	5 00	5 00	617 07
Fall Creek Hatchery.....	390 95	826 96	442 03
Mount Whitney Hatchery.....	1,444 29	1,760 91	2,859 33
Cottonwood Creek Station.....	-----	25 00	-----
Cottonwood Lakes Station.....	239 00	97 16	-----
Tahoe Hatchery	100 00	5 00	5 00
Tallac Hatchery	372 75	566 13	581 36
Chico Experimental Station.....	250 00	221 72	30 00
Fort Seward Hatchery.....	384 10	696 01	630 76
Eel River Station.....	-----	-----	-----
Ukiah Hatchery	311 01	496 02	139 15
Snow Mountain Station.....	-----	157 00	-----
Brookdale Hatchery	388 05	492 30	442 98
Scott Creek Station	30 00	31 00	31 00
Feather River Hatchery.....	-----	-----	-----
Almanor Hatchery	332 70	162 50	149 36
Domingo Springs Hatchery.....	473 56	1,331 49	992 47
Clear Creek Hatchery.....	162 57	145 64	1,163 93
Bear Lake Hatchery.....	269 03	443 52	716 41
North Creek Station.....	208 25	31 34	-----
Wawona Hatchery	93 76	127 70	-----
Yosemite Hatchery	176 93	284 05	251 64
Kaweah Hatchery	112 51	156 21	180 54
Fish Transplanting	3 00	3 00	3 00
Screens, fishways and water pollution.....	635 84	686 19	883 30
Special field investigation.....	-----	-----	-----
	\$10,060 65	\$15,632 82	\$17,132 24
Department of Commercial Fisheries.....	3,914 92	4,283 53	5,035 21
	\$36,844 96	\$45,531 90	\$49,259 73